

AC.12.


REPORT
OF THE
SUDAN MEDICAL SERVICE
FOR THE YEAR
1938



REPORT
OF THE
SUDAN MEDICAL SERVICE
FOR THE YEAR

1938





Digitized by the Internet Archive
in 2019 with funding from
Wellcome Library

<https://archive.org/details/b31491078>

ANNUAL REPORT 1938.

SUDAN MEDICAL SERVICE.

	PAGE
1. General	1
2. Epidemic Diseases	5
1. Cerebrospinal Meningitis.	5
2. Diphtheria.	5
3. Influenza.	6
4. Relapsing Fever.	6
5. Smallpox.	7
3. Endemic Diseases	10
1. Ancylostomiasis.	10
2. Bilharziasis.	10
3. Blackwater Fever.	12
4. Dracontiasis.	13
5. Dysentery.	13
6. Enteric Fever.	14
7. Hydatid disease.	14
8. Leishmaniasis.	14
9. Leprosy.	17
10. Malaria.	20
11. Rabies.	22
12. Rheumatism.	23
13. Scurvy.	23
14. Sleeping Sickness.	23
15. Tuberculosis.	26
16. Tumours.	28
17. Undulant Fever.	29
18. Venereal Diseases.	29
19. Yaws.	30
4. Public Health and Hygiene (By Mr. H. A. Crouch)	31
1. Introduction.	
(a) General Health.	31
(b) General Sanitation.	31
(c) The Prevention of Disease.	31
(d) The Control of Malaria.	33
(e) Water Supplies.	33
(f) Aedes Aegypti Survey.	34
(g) Sanitary Control of Aircraft.	35
(h) Housing.	35
(i) Nutrition.	36
(j) Staff.	37
2. The Health and Sanitation of Provinces.	38
(a) Khartoum.	38
(b) Northern.	53
(c) Blue Nile.	53
(d) Kassala.	54
(e) Kordofan.	57
(f) Darfur.	57
(g) Upper Nile.	58
(h) Equatoria.	59
3. Maternity and Child Welfare.	60
4. School Medical Service.	63
5. Quarantine.	65
5. Ophthalmic Report (By Mr. A. R. McKelvie)	67
6. Stack Medical Research Laboratories (By Dr. E. S. Horgan)	71
7. Medical Entomology	81
8. Progress of Work	91
9. Training	94
10. Kitchener School of Medicine (By Mr. J. S. Aldridge)	95
11. Health of Sudan Defence Force (By Mr. N. Macleod)	97
12. Missions	101
13. Organisation	102
14. Staff	107
15. Financial	110
16. Statistics	111
17. Index	117

ANNUAL REPORT

OF THE SUDAN MEDICAL SERVICE

FOR THE YEAR 1938.

GENERAL HEALTH.

The public health of the Sudan as a whole remained satisfactory throughout the year although it was adversely affected locally by epidemic disease. The Sudan was again spared the extensive epidemics of cerebrospinal meningitis which swept the country two years ago. Outbreaks of smallpox and relapsing fever occurred in Kassala, Blue Nile, Kordofan and Darfur Provinces and were only kept under control by constant effort and vigilance. Phenomenal, badly spaced rains combined with a record high flood level of the river caused a heavy incidence of malaria in parts of the northern Sudan including Khartoum.

HEALTH OF OFFICIALS.

NATIONALITY	Number of Officials employed	Total		Average days sickness		Died	Invalided
		Placed on sick list	No. of days sickness	For all officials	For those who were sick		
British	864	246	1,920	2.22	7.80	1	2
Sudanese	3,281	919	8,454	2.57	9.19	6	8
Egyptian	539	127	1,029	1.91	8.10	1	3

The comparative figures for the past five years are as follows :—

	1934	1935	1936	1937	1938
British.					
Days Sickness	1.33	1.32	1.56	1.15	2.22
Died	2	1	2	1	1
Invalided	2	3	2	1	2
Sudanese.					
Days Sickness	1.56	1.42	1.48	1.58	2.57
Died	8	5	14	6	6
Invalided	7	13	4	11	8
Egyptians.					
Days Sickness	1.09	1.17	1.66	1.34	1.91
Died	3	3	4	—	1
Invalided	—	1	2	8	3

The considerable increase in sickness among all races is due to the prevalence of malaria in Khartoum and other towns in the northern Sudan where the majority of officials are stationed.

PROGRESS OF WORK.

The curative work carried out at hospitals and dispensaries again showed an increase although this was partly due to the high incidence of malaria in Khartoum and Blue Nile Provinces. Every effort is being made to develop the preventive side of medicine. The organisation of a network of subordinate Sudanese public health officials covering every part of the country is practically complete except in the southern Sudan where training of local staff takes longer and is more difficult. Steps are being taken to instruct the public wherever possible regarding the public health and anti-malarial measures which should be carried out in their homes.

School medical work is being organised and developed throughout the country as rapidly as possible. Attention is being paid to the improvement of water supplies both as regards village wells and piped water supplies in towns.

Special committees are coordinating the activities of the various departments concerned in the improvement of native housing and nutrition.

The Graphic Museum has proved of great value both for teaching medical and public health students, and for health propaganda among the public.

EPIDEMIC DISEASES.

At the beginning of the year smallpox was sporadic in Kassala and Blue Nile Provinces where a constant stream of infection from across the border continuously reintroduced the disease.

In Kassala Province the disease had been prevalent for some months previously and by the end of 1937 vaccination of the people was almost complete. As a result the disease soon died out. In the southern districts of the Blue Nile Province, the infection subsided for similar reasons but in two villages of the irrigated area of the Gezira virulent outbreaks occurred in January. Here many of the women had escaped vaccination although an intensive vaccination campaign had been carried out in this district during the last three months of 1937. These as well as a few small secondary outbreaks were stamped out at once. Small outbreaks occurred in the eastern and southern districts of Kordofan Province in the first half of the year and the disease then died out throughout the Sudan to reappear in Darfur Province in November where pilgrims proceeding eastwards introduced the disease from French Equatorial Africa. The disease remained sporadic. A vaccination campaign was organised to vaccinate the whole of Darfur Province and is still in progress.

Relapsing fever occurred sporadically in Kassala and Blue Nile Provinces, and two small outbreaks were reported in Darfur where memories of the appalling epidemics of this disease in the past cause its appearance to be regarded with grave anxiety. An extensive delousing campaign was organised and immediate medical assistance provided. As a result the disease did not become epidemic and the mortality was low.

ENDEMIC DISEASES.

The incidence of bilharziasis remains negligible, although it is only by constant effort that it is possible to prevent the irrigated area of the Gezira from becoming infected.

Investigations are at present being carried out on kala-azar which remains mildly endemic over a large area. The incidence of leprosy as far as can be assessed shows little change.

The incidence of malaria was high in Khartoum, Blue Nile, and Darfur Provinces owing to very heavy and badly spaced rains combined with a record high flood level of the River. The anti-malarial staff has been strengthened in many areas and the results of their work are already apparent in the Northern Province.

Sleeping sickness remains endemic in the Zande district although it is hoped that systematic fly destruction along the river, which is worst affected, will soon reduce the incidence. The small outbreak near Kajo-Kaji has been stamped out. A small experiment with prophylactic Bayer 205 is being carried out to deal with a small focus of infection near Yambio.

The incidence of tuberculosis shows no change.

QUARANTINE.

8,159 pilgrims left Suakin for Jedda, the largest number ever reached. Calf lymph and cholera vaccine made at the Stack laboratories were used. It was possible to reduce the period of quarantine for returning pilgrims from five

to three days at the beginning of the pilgrimage season and this was reduced later to one day only. At Port Sudan no ships were quarantined and there were no cases of infectious disease from ships.

At Wadi Halfa 1,330 Egyptian labourers passed through the quarantine of whom 81 were treated for bilharziasis either at Wadi Halfa or their destination, and 2 were repatriated as unfit.

TRAINING.

27 students were under training at the Kitchener School of Medicine during the year. 8 sat for the intermediate examinations in Anatomy and Pharmacology in May and all passed. Eleven sat for the first professional examination in Chemistry, Physics and Biology, of whom seven were successful. Seven sat for the final examination in Medicine, Surgery, and Obstetrics and Gynaecology of whom six passed, and one was referred for three months in Medicine. In addition one student referred from last year passed a special final examination held in April. The Medical School is now organised on a five year course and the Conjoint Board of the Royal Colleges in England have recognised the whole period spent in taking the course as counting towards taking a conjoint qualification, provided an educational standard is reached before entering the school. Two candidates sat for the diploma of the Royal Sanitary Institute, both of whom were successful.

Training classes were held for dispensers, sanitary overseers, female nurses, midwives, laboratory assistants, medical assistants and hospital orderlies.

Two Sudanese medical officers completed a three months post-graduate course in London during the year.

STACK MEDICAL RESEARCH LABORATORIES.

Investigations were carried out on various diseases including kala-azar, relapsing fever and yellow fever during the year. The Medical Entomologist continued his investigations concerning the anopheline mosquitoes of the Gezira and Khartoum districts and concerning sand flies in connection with the kala-azar investigations. The local production of vaccine lymph proved of immense value during the year in dealing with numerous small outbreaks of smallpox throughout the northern Sudan. 1,300,000 units were issued and it was largely due to its high potency, which gave nearly 100% successful "takes" in the unvaccinated, that it was possible to control the disease effectively.

22,633 routine examinations were carried out during the year compared with 20,432 in 1937, despite the fact that as much routine work as possible was decentralised to provincial hospital laboratories.

EPIDEMIC DISEASES.

CEREBROSPINAL MENINGITIS.

234 cases were reported with 124 deaths, distributed by Provinces as under :—

PROVINCE							Cases	Deaths.
Blue Nile	...	...	...	...	...	...	14	6
Darfur	...	...	...	...	...	...	7	2
Equatoria	...	...	...	...	...	...	172	95
Kassala	...	...	...	...	...	...	3	3
Khartoum	...	...	...	...	...	...	8	4
Kordofan	...	...	...	...	...	...	11	6
Northern	...	...	...	...	...	...	19	8
							234	124

The incidence of this disease during the last ten years has been as follows :—

Year.		Cases.	Deaths.	Year.		Cases.	Deaths.
1929	...	464	340	1934	...	4231	3341
1930	...	865	665	1935	...	3249	2154
1931	...	348	240	1936	...	13440	8906
1932	...	532	384	1937	...	446	293
1933	...	166	131	1938	...	234	124

The extensive epidemics, which ravaged the central and western Sudan recently, appear to have died down and the disease has only been reported in sporadic form during the year, except in the Aweil district of Equatoria Province. Here an outbreak, which had abated with the advent of the rains in 1937, flared up again during the following dry season.

Under field conditions treatment in the past has been of little use and the only effective measure to deal with the disease was evacuation of villages to temporary shelters, if possible, sufficiently numerous to allow one shelter for each person. New drugs however are at present being tried out and treatment with drugs of the sulphonamide group has so far given very promising results.

DIPHTHERIA.

51 cases with 13 deaths were reported compared with 36 cases and 8 deaths in 1937.

With the exception of Darfur and Upper Nile all provinces were affected. The distribution was as follows :—

PROVINCE.		Cases	Deaths	PROVINCE.		Cases	Deaths
Blue Nile	...	5	2	Khartoum	...	34	5
Equatoria	...	1	1	Kordofan	...	3	1
Kassala	...	5	2	Northern	...	3	2

The incidence for the last ten years has been :—

Year.				Cases.	Year				Cases.
1929	...	...	...	177	1934	...	...	...	34
1930	...	...	...	68	1935	...	...	...	60
1931	...	...	...	183	1936	...	...	...	63
1932	...	...	...	138	1937	...	...	...	36
1933	...	...	...	51	1938	...	...	...	51

The small focus of infection in the cataract country south of Wadi Halfa appears to have died out.

It is to be expected that the incidence will increase as contact with the outside world becomes closer.

Two cases were reported from Equatoria Province in 1937 for the first time and a further case is reported this year.

INFLUENZA.

As last year, outbreaks of a virulent type with considerable mortality, occurred in the Equatoria Province and in the Nuba Mountains. Elsewhere, minor outbreaks of a mild type occurred during the winter months.

RELAPSING FEVER.

1,124 cases were reported with 116 deaths compared with 374 cases with 48 deaths in 1937.

Cases were distributed among Provinces as follows :—

PROVINCE			Cases	Deaths	PROVINCE			Cases	Deaths
Blue Nile ...	...	...	670	51	Khartoum	...	...	16	—
Darfur ...	...	...	212	45	Kordofan ...	...	...	66	6
Kassala ...	...	...	158	14	Northern ...	...	...	2	—

This disease which had spread into the eastern Sudan from Abyssinia remained sporadic in Kassala Province.

Despite rigorous measures taken to prevent its spread to the irrigated area of the Gezira, sporadic cases continued to be reported from this area, mostly among the numerous immigrants from the east and it was only by a widespread delousing campaign and early treatment of cases that it was possible to keep the disease under control. Particular attention was paid to the casual labour employed at the ginning factories.

Further west it was not possible to maintain such close supervision with the result that three small outbreaks were reported in the eastern part of Darfur Province. Adequate measures were taken to deal with the disease as soon as the outbreaks were reported and it was possible to stamp it out before reaching epidemic proportions or spreading to the extremely susceptible population further west. Although it was possible to prevent the disease becoming epidemic by using every preventive measure available, including the delousing of approximately 100,000 persons, its occurrence in the Sudan and in particular the western Sudan, must always give cause for grave anxiety in view of the appalling epidemics which have swept the country in the past.

It is impossible to prevent the spread of the disease as it occurs among a shy, wandering, foreign population which wends its way casually across the Sudan to and from Mecca. Experience has shown that not only may the spirochaetes appear in the blood of persons shortly after they have been medically examined, passed fit and deloused and have then travelled to a different area, but that many sufferers from the disease are not sufficiently ill to have any obvious symptoms, far less to report sick. This accounts for its spread west and east, despite establishment of delousing stations at many centres along the route and rigid control and medical supervision of persons travelling by train and car.

SMALLPOX.

527 cases were reported with 158 deaths, with the following distribution by Provinces :—

Province.	Cases.	Deaths.	Province.	Cases.	Deaths.
Blue Nile	320	112	Khartoum	2	1
Darfur	78	11	Kordofan	106	33
Kassala	20	1	Northern	1	—

1,347,258 persons were vaccinated, compared with 561,196 in 1937, in the following provinces :—

Blue Nile	876,172	Kassala	58,240	Northern	45,305
Darfur	46,711	Khartoum	58,564	Upper Nile	175
Equatoria	1,700	Kordofan	260,391		

General.

At the beginning of the year the disease was sporadic in Blue Nile and Kassala Provinces where a constant stream of immigrants from across the border was reintroducing the infection. In Kassala Province, where the disease had been prevalent for some months in 1937 and as a result the vaccination campaign almost complete, it remained sporadic and soon died out. In the Blue Nile Province, the remote area south of Kurmuk close to the Abyssinian border which had been infected sporadically for the previous two years, continued to produce cases until May when the disease died out.

In the Gezira about 185,000 vaccinations had been carried out during the last three months of 1937, but two short but virulent outbreaks occurred in January of this year owing to the fact that many of the women in the villages had evaded vaccination. These were dealt with at once, as well as several secondary outbreaks which occurred in and adjacent to the Gezira, and the disease died out in March. In Kordofan Province small outbreaks were reported in the Nuba Mountains and the Eastern District traced to a case from Eritrea. The disease rapidly died out as the result of extensive vaccination, except in the Sherkeila area in eastern Kordofan where cases continued to be reported until June.

A few sporadic cases were reported from Darfur, Khartoum, and the Northern Provinces in the first half of the year.

During the last three months of the year cases were reported from western Darfur. Pilgrims now proceeding eastwards had been infected in French Equatorial Africa and were carrying the disease into the Sudan. It was necessary therefore to establish a quarantine at Geneina and to carry out an extensive vaccination campaign throughout Darfur Province.

Blue Nile Province (Gezira.)

The following extracts from a note by Drs. Horgan and Goss are relevant :—

Sporadic cases of smallpox had been appearing in the area since October 1937, the majority of cases being immigrant West African labourers. Vaccination had been carried out since that date and by the end of the year 185,000 people had been vaccinated. On January 20th 1938 a report was received from the village of Sharafat that there were 14 cases of smallpox and the diagnosis was confirmed by the Senior Medical Inspector of the district. On the 21st a house to house inspection revealed that the total number of cases was 49. The village was surrounded by police and all entrance and exit was forbidden. Vaccination was commenced and 1,500 people were vaccinated by the 22nd January. The total population of the village was estimated to be about 3,000 of which 1,200 were found to have been recently vaccinated. 17 contact cases were discovered in 4 neighbouring villages. A local quarantine was built at Sharafat and all infected people were removed from the villages and treated in the quarantine. Numerous cases were reported in Sharafat and the surrounding district during the next few days.

The first case at Sharafat was not reported. A recently married woman, who according to custom was living in partial seclusion with her husband, was taken ill about the 3rd of January. The husband reported to her relatives that she was sick but no steps were taken to find out the nature of the illness nor to seek assistance. When it was realised that she was going to die, information was sent to her relatives and acquaintances and she was visited by large numbers of people. She died on 14th January. As a result of the case, there were 131 cases of smallpox of which 119 were direct contacts and 12 secondary contacts. The last case of the Sharafat outbreak occurred on the 1st February. There were 54 deaths. On the 24th January a case of smallpox died at Talbab village a few miles from Sharafat. As a result of this case there was an outbreak at Talbab of 39 cases with 9 deaths. These cases had been vaccinated on the 27th. January and all the vaccinations were successful but were done too late in the incubation period to prevent the disease, although the mortality was considerably reduced i.e., 23% as compared with 41% in Sharafat.

It was impossible to keep a record of the incidence by age and sex but the following table summarises all cases in the Gezira occurring during January and February 1938 including 7 sporadic cases in and near the town of Wad Medani. These cases which are included here for convenience had no connection with the two above outbreaks but were probably introduced from the east side of the Blue Nile.

				Cases.	% Cases.	Deaths	% Deaths.
Male	...	...	...	53	29.9	12	22.6
Female	...	...	...	124	70.1	52	41.9
TOTAL				177	100	64	36.2

Of the above 98% were adults. The high percentage of women is due to the fact that many women had avoided vaccination when the campaign was carried out at the end of the previous year.

Vaccination.

All the vaccine lymph used was glycerinated calf lymph prepared in the Stack Medical Research Laboratories. The previous vaccination campaign was greatly intensified. Vaccinators were distributed throughout the Gezira under the supervision of British officials and every village was visited.

During the five months ending February 1938, 773,000 vaccinations were carried out and the campaign was carried on vigorously until April. These figures include both the fixed and floating population of the irrigated area and also the inhabitants in the northern Gezira area to the boundary of Khartoum, the area southwards towards Sennar and those on the east bank of the Blue Nile as far as the boundaries of Kassala Province.

Owing to the extensive vaccination campaign the epidemic was abruptly brought to an end after the first two outbreaks.

The percentage of successful vaccination in unvaccinated individuals without any previous history of the disease was very high, being estimated by experienced British doctors at almost 100%

Incidence in regard to Previous Vaccination.

The following figures include all cases in the Gezira area during January and February 1938 :—

Unknown	...	...	...	...	...	...	...	...	...	50
Never vaccinated	...	...	...	...	...	...	...	...	...	51
Variola (arm to arm) vaccination 40 to 50 years ago	...	...	...	...	...	...	...	...	...	11
Vaccinated in infancy	...	...	...	...	...	...	...	...	...	12
Vaccinated more than 15 years previously	...	...	...	...	...	...	...	...	...	30
Vaccinated more than 10 years previously	...	...	...	...	...	...	...	...	...	19
Vaccinated more than 5 years previously	...	...	...	...	...	...	...	...	...	—
Vaccinated more than 3 years previously	...	...	...	...	...	...	...	...	...	—
Vaccinated more than 3 months previously	...	...	...	...	...	...	...	...	...	4*

* Mild modified cases all of whom recovered.

Vaccinated During Incubation Period.

10-14 days before appearance of disease	...	...	...	...	...	...	...	...	...	—
9	..	..	..	..	..	..	..	..	..	2
8	..	..	..	..	..	..	..	..	..	1
7	..	..	..	..	..	..	..	..	..	47
6	..	..	..	..	..	..	..	..	..	1
5	..	..	..	..	..	..	..	..	..	—
4	..	..	..	..	..	..	..	..	..	2
3	..	..	..	..	..	..	..	..	..	1
2	..	..	..	..	..	..	..	..	..	3
1	..	..	..	..	..	..	..	..	..	—

It must be emphasized that although every care was taken in the compilation of these figures it is very difficult to obtain accurate ideas of dates from the primitive patients.

ENDEMIC DISEASES.

ANCYLOSTOMIASIS.

This disease is of no importance in the northern Sudan where a few very restricted endemic centres occur in the Northern Province, but it is a major problem west of the White Nile in Equatoria where much disability is caused. Juba, Kajo-Kaji, Rumbek and Wau are the principal infected districts and in Rumbek it is the main cause of invalidism.

BILHARZIASIS.

The position as regards this disease is satisfactory and it is now of little public health importance in the northern Sudan.

The incidence in the irrigated area of the Gezira remains negligible although it is only by continuous effort and close supervision that it has been possible to prevent this important area from becoming an endemic centre.

The incidence in many parts of the Northern Province, notably Dongola and Merowe districts, has been reduced to negligible proportions as the result of mass examination, treatment and mollusc destruction over a long period. It has also been possible, by providing safe village water supplies, to reduce the incidence of rectal bilharziasis in the White Nile area. By far the greater number of cases are now diagnosed by routine examination before the patient complains of any symptoms and few cases are ill enough to report to hospital, far less to require inpatient treatment.

Although the disease is at present of no public health importance as a cause of morbidity or mortality, the closest observation and most drastic preventive measures will always be required to prevent it becoming endemic in the perennially irrigated area of the Gezira. This area is constantly exposed to risk of infection owing to the influx of immigrants from infected areas in other parts of the Sudan and from neighbouring countries.

Experience in other countries indicates that, if the disease became endemic in this area not only would it have a disastrous effect on the population, which at certain times of the year may already be weakened by malaria, but that it would be practically impossible to eradicate it.

EQUATORIA PROVINCE.

Schistosoma Mansoni is prevalent in Wau, Yei and Zande districts. Although generally mild it is a cause of disability in certain areas.

KASSALA PROVINCE.

Water holes in the southern part of this province became infected for the first time this spring and 153 cases of vesical schistosomiasis were found in the Qala En Nahl group of villages.

All cases were treated and cured before the rainy season and after the rains measures were taken to prevent bathing in and fouling of the water holes when they filled again. Despite this 22 cases were reported in November.

The water holes will be treated with disinfectant to kill snails when the volume of water is sufficiently reduced, and their beds, when dry, will be dug up and left exposed to the sun.

BLUE NILE PROVINCE.

The following table shows the incidence of the disease among the indigenous population of the irrigated area of the Gezira since 1926 :—

YEAR.	ADULTS.			CHILDREN.			TOTAL.		
	No. Exmd.	No. Infld.	%	No. Exmd.	No. Infld.	%	No. Exmd.	No. Infld.	%
1926	16,419	76	0.47	—	—	—	16,419	76	0.47
1929	—	—	—	2,341	37	1.60	2,341	37	1.60
1930	—	—	—	3,322	20	0.57	3,322	20	0.57
1931	11,102	84	0.75	6,895	51	0.74	17,997	135	0.75
1932	9,618	51	0.53	1,707	19	1.10	11,325	70	0.62
1933	14,188	28	0.20	3,288	27	0.82	17,476	55	0.31
1934 ...	12,769	5	0.04	3,583	2	0.07	16,352	7	0.04
1935 ...	13,902	8	0.06	2,945	12	0.40	16,847	20	0.12
1936	22,604	10	0.04	5,483	17	0.31	28,087	27	0.09
1937	30,768	26	0.08	10,038	63	0.62	40,806	89	0.22
1938	32,045	50	0.15	16,916	162	0.95	48,961	212	0.43

Dr. Goss, Senior Medical Inspector, Blue Nile Province, emphasises that the permanent solution of the bilharzia problem is a good water supply. A programme for providing suitable village wells and piped water supplies to the larger villages was carried out during the year. The other usual preventive measures have been carried out *i.e.*, siting of villages 300 metres from canals, prevention of bathing, provision of latrines and disinfection of canals to kill snails.

NORTHERN PROVINCE.

Dongola and Merowe Districts. A yearly survey is carried out in these districts and the comparative figures for the last ten years are :—

YEAR	Number examined	Infections found	Percentage	YEAR	Number examined	Infections found	Percentage
1929 ...	17,925	2,187	12.2	1934 ...	46,054	1,768	3.8
1930 ...	26,094	2,443	9.3	1935 ...	40,950	1,408	3.4
1931 ...	37,405	1,765	4.6	1936 ...	37,334	1,268	3.4
1932 ...	49,077	2,470	5.0	1937 ...	46,741	1,155	2.5
1933 ...	58,711	1,825	3.1	1938 ...	44,517	891	2.0

Wadi Halfa District. The results of the campaign in this district, organised five years ago, are as shown by the figures of the yearly survey given below :—

YEAR	Number examined	Infections found	Percentage	YEAR	Number examined	Infections found	Percentage
1934 ...	20,180	3,927	19.4	1937 ...	18,498	2,002	10.8
1935 ...	12,076	2,613	21.6	1938 ...	21,958	2,763	12.5
1936 ...	12,437	1,439	12.9				

Berber and Shendi Districts. The disease is on the decrease in this area although isolated endemic foci still exist in the northern end of Berber district and north of Zeidab.

BLACKWATER FEVER.

29 cases were reported with 8 deaths.

The figures for the last six years are as follows :—

Year.			Cases.	Deaths.	Year.			Cases.	Deaths.
1933	...	...	38	12	1936	...	...	38	14
1934	...	...	34	9	1937	...	...	20	5
1935	...	...	18	9	1938	...	...	29	8

The nationalities affected were :—

						Cases.	Deaths.
Sudanese	Arab	...	...	...	...	18	6
„	Negroid	...	...	...	...	2	—
Greek	...	...	...	...	...	3	—
Italian	...	...	...	...	...	2	1
Egyptian	...	...	...	...	...	2	—
Abyssinian	...	...	...	...	...	1	1
British	...	...	...	...	...	1	—
						29	8

The following table shows the incidence by age and sex in the various areas :-

PROVINCE	DISTRICT	MALE		FEMALE		AGE GROUPS.							
		A	D	A	D	0-1	1-5	5-15	15-25	25-35	35-45	45-65	65 and over
Blue Nile	Gezira	5	2	1	—	—	—	—	3	1	2	—	—
	Fung	2	—	—	—	—	—	—	—	1	1	—	—
	White Nile	1	—	1	—	—	—	—	—	2	—	—	—
Darfur	Nyala	1	1	—	—	—	—	—	—	—	1	—	—
Equatoria	Wau	3	—	—	—	—	—	—	1	2	—	—	—
	Torit	2	1	—	—	—	—	—	—	1	1	—	—
Kassala	Kassala	2	1	—	—	—	—	1	—	1	—	—	—
Khartoum	Khartoum	1	1	1	—	—	—	—	—	1	1	—	—
Kordofan	Central	1	—	—	—	—	—	—	—	1	—	—	—
	Western	1	—	—	—	—	—	—	—	—	—	1	—
	Nuba Mts.	3	—	—	—	—	—	1	—	1	1	—	—
Northern	Shendi	1	1	—	—	—	—	—	—	—	1	—	—
Upper Nile	Malakal	2	1	1	—	—	—	2	1	1	—	—	—
TOTAL		25	8	4	—	—	—	4	5	11	8	1	—
DEATHS						—	—	—	1	1	6	—	—

DRACONTIASIS.

This disease is the cause of much disability in the Nuba Mountains, Equatoria Province and the Bor district of Upper Nile Province. In the southern Sudan preventive measures carried out are the construction of properly protected wells and the treatment of those suffering from the disease. 163 wells have been constructed in Juba district and 22 in Yei district to date. In the Nuba Mountains the problem is more difficult, because the Nubas drink from numerous rock pools which hold water for most of the year, and it is difficult either to construct sufficient wells to provide an adequate, convenient water supply or to persuade the independent mountain dwellers to use them. Fortunately the disease is restricted to a few mountain ranges. It is intended to work out a programme of well construction next year in the endemic area and to persuade the people by constant propaganda to drink well water instead of the far more handy supply from water holes.

PROVINCE.			Cases treated	PROVINCE.			Cases treated
Blue Nile ...	...	...	102	Khartoum...	...	...	8
Darfur ...	...	...	47	Kordofan ...	...	...	443
Equatoria...	...	...	2,416	Northern ...	...	...	—
Kassala ...	...	...	1	Upper Nile	...	...	326
TOTAL ...				... 3,343			

DYSENTERY.

3,023 cases were admitted to hospital of which 2,886 were diagnosed as amoebic and 137 as bacillary dysentery.

It is probable that bacillary dysentery is more common than these figures indicate, because of the difficulty of accurate diagnosis in the absence of laboratory facilities.

It is comparatively rare in the country districts compared with the towns, although occasionally it occurs in epidemic form in parts of the southern Sudan.

In the northern Sudan, the sun and dry climate with a long dry season are adverse factors which may account for the low incidence in rural areas.

The incidence of bacillary dysentery gives some indication of the standard of public health, particularly in the towns, and the steady decline which has occurred during recent years corresponds with a general improvement in the standard of sanitation.

Taking the Sudan as a whole dysentery is certainly far less prevalent among all sections of the community than it was ten years ago.

The following table shows the admissions to hospital, given as the percentage of the total admissions from all causes, for 1938 and the preceding nine years :—

		1929	1930	1931	1932	1933	1934	1935	1936	1937	1938
Amoebic Dysentery	...	3.02	2.68	3.28	2.51	3.25	3.00	2.83	2.49	2.48	2.76
Bacillary Dysentery	...	0.75	0.37	0.41	0.41	0.38	0.28	0.26	0.18	0.13	0.13
TOTAL	...	3.77	3.05	3.69	2.92	3.63	3.28	3.09	2.67	2.61	2.89

ENTERIC FEVER

213 cases of typhoid and paratyphoid fevers were reported with 29 deaths.

The following table shows the incidence of this disease during the last ten years :—

1929	...	...	...	86	1934	...	...	...	188
1930	...	...	...	73	1935	...	...	...	246
1931	...	...	...	100	1936	...	...	...	135
1932	...	...	...	85	1937	...	...	...	165
1933	...	...	...	204	1938	...	...	...	213

This disease was introduced into the Sudan from abroad as the result of increased contact with the outside world and even now is largely restricted to areas such as Khartoum, Khartoum North, Omdurman, Kassala and Malakal, where infection from outside the Sudan is particularly liable to occur.

For this reason the figures cannot be taken as an accurate indication of the sanitary state of the towns concerned. The disease has an irregular, sporadic distribution and it has not been possible to connect cases with water supplies. Flies and carriers are the most probable sources of infection.

Of the 213 cases reported in 1938, 209 were typhoid and 4 were paratyphoid A. The incidence in Malakal and Kassala was considerably above average.

It is to be expected that the incidence in the Sudan as a whole will rise in future as contact with other countries increases, although, no doubt, the continual raising of the standard of sanitation will act as a check.

HYDATID DISEASE.

This disease is confined to the Equatoria Province where 19 cases were reported from the endemic area of Kapoeta in 1938 compared with 26 in 1937 and 10 in 1936 ; one case was again reported from Wau.

LEISHMANIASIS.

295 cases were reported compared with 336 in 1937 and 214 in 1936.

KALA-AZAR.

Kala-azar has a curious distribution in the Sudan being mildly endemic along the eastern border from Kassala, near the frontier of Eritrea, to Kapoeta in Equatoria Province near the Kenya border, and sporadic throughout the western, central, and southern Sudan. Investigations are at present being carried out under the direction of the Senior Medical Research Officer regarding its etiology, but it is difficult to account for the solitary isolated cases which occur so frequently in the Sudan by the presence of any insect vector, and its epidemiology resembles in many ways that of cerebrospinal meningitis. The investigations carried out by Sir Robert Archibald in Singa district indicated that it might sometimes be spread by human carriers or infected persons in a very early stage of the disease before they are seen in hospital. The sandfly distribution in the endemic area is at present under investigation.

The disease appears to cling to certain families or possibly certain houses where numerous cases may occur in quick succession. There is reason to believe that the local monkeys may be infected in the endemic areas. This may explain how the disease is maintained in the absence of man as was found to be the case in Gedaref district where 10% of a party of soldiers, entering a district along the Atbara river, contracted the disease. This district had long been evacuated by the whole population because it was unhealthy, probably owing to kala-azar.

It is of interest to note that the type of the disease appears to be changing. Leishman-Donovan bodies were frequently reported in the blood by investigators in the Singa area twenty years ago but are now rarely seen in cases from this district, although frequently reported in cases from Kapoeta.

The results of treatment vary considerably in different areas, but on the whole the disease seems more resistant to treatment in the Sudan than elsewhere.

In the Sudan its distribution does not vary appreciably from year to year and it is probable that the incidence also remains fairly constant. Cases are liable to be missed owing to the difficulty of diagnosis.

For these reasons, it is not at present a serious public health problem, but if at any time the disease became epidemic and spread to the irrigated area of the Gezira, which lies close to the principal endemic area, the results might be very serious, particularly if the resistance of the population had been previously lowered by malaria.

Blue Nile Province.

116 cases were treated in the Fung area compared with 134 in 1937. The case mortality remains at about 20%.

Equatoria Province.

83 cases of kala-azar were diagnosed in Kapoeta district in 1938 compared with 58 in 1937. This increase is largely due to a number of cases found during a survey along the River Lokalyan.

Kassala Province.

Six cases were reported in Kassala district compared with 10 in 1937, and 19 in Gedaref compared with 40. Dr. Clarke, Senior Medical Inspector, Kassala Province, reports that "what appeared to be Leishman-Donovan bodies were found in a body louse taken from an infected case."

Upper Nile Province.

The distribution of the disease appears to be more extensive than was formerly supposed and three cases were reported from districts west of the Nile.

ESPUNDIA.

Three cases of espundia were reported during the year, of which one was from Kassala and two from the Fung area.

CUTANEOUS LEISHMANIASIS.

Six cases were reported of which three were from the Fung and one each from Darfur, Kordofan and Equatoria Provinces.

DISTRIBUTION.

PROVINCE.	DISTRICT.	Male		Female		AGE INCIDENCE.							
		A	D	A	D	0-1	1-5	5-15	15-25	25-35	35-45	45-65	Over 65
Blue Nile	Gezira ...	12	5	—	—	—	—	1	7	3	1	—	—
	Fung ...	101	20	20	5	—	10	19	49	31	10	2	—
	White Nile	2	—	—	—	—	—	1	—	1	—	—	—
Darfur	Darfur ...	9	1	3	—	—	—	6	3	2	—	—	1
Equatoria	Wau ...	4	2	—	—	—	—	2	1	1	—	—	—
	Torit ...	1	—	—	—	—	—	—	—	1	—	—	—
	Kapoeta	55	2	28	1	—	7	59	8	5	4	—	—
Kassala	Kassala ...	7	1	—	—	—	—	1	2	3	1	—	—
	Gedaref ...	19	7	—	—	—	—	3	8	4	4	—	—
	Port Sudan	3	—	—	—	—	—	—	1	1	1	—	—
Khartoum	Khartoum	5	1	—	—	—	—	1	1	2	1	—	—
	Omdurman	5	2	—	—	—	—	1	3	1	—	—	—
Kordofan	El Obeid	1	—	—	—	—	—	—	—	1	—	—	—
	Nuba Mts.	1	—	1	1	—	—	—	—	2	—	—	—
Northern	Atbara ...	1	—	—	—	—	—	—	1	—	—	—	—
	Shendi ...	1	—	—	—	—	—	—	1	—	—	—	—
Upper Nile	Malakal ...	14	5	2	1	—	—	5	6	4	1	—	—
	TOTAL ...	241	46	54	8	—	17	99	91	62	23	2	1
Deaths ...						—	2	6	26	12	7	1	—

RACE.

The races affected were :—

Sudanese (Arab) ...	...	135	Abyssinians ...	...	...	5
„ (Negroid) ...	...	140	Eritreans ...	...	...	1
West Africans ...	...	13	British ...	...	...	1

RESULTS OF TREATMENT.

	Apparently cured %	Died %	Still under treat- ment %	Untreated or lost sight of %
1937	37	17	28	18
1938	35.6	18.3	18.7	27.4

LEPROSY.

The following table shows the distribution of lepers in the Sudan :—

PROVINCE.					Under treatment in camps or settlements	Under observation and treatment as hospital or dispensary outpatients	Total under treatment	Under observation but not under treatment	Total cases
Blue Nile	...	...	...	...	45	22	67	80	147
Darfur	...	...	...	...	—	7	7	—	7
Equatoria	...	...	...	...	1,763	—	1,763	2,831	4,594
Kassala	...	...	...	...	19	—	19	—	19
Khartoum	...	...	...	...	—	29	29	—	29
Kordofan	...	...	...	...	102	26	128	1,713	1,841
Northern	...	...	...	...	—	56	56	2	58
Upper Nile	...	...	...	...	—	6	6	—	6
					1,929	146	2,075	4,626	6,701

The estimated number of lepers in the Sudan is approximately 8,000.

NORTHERN SUDAN.

Leprosy is a comparatively rare disease in the northern third of the Sudan, only 11 new cases occurring during the year in Khartoum Province with a population of 252,395. The standard of living is higher than in the remainder of the Sudan with a reasonable standard of housing. Consequently it is possible to arrange a system of home isolation which has proved the most satisfactory way of dealing with lepers in this area. The lepers live at home in a separate house or room under the supervision of the public health or dispensary staff, taking the usual precautions to avoid spreading contagion.

It has been found that the lepers keep fitter and are happier than in settlements and there appears to be little risk to their relatives.

They report at the nearest dispensary, or in Khartoum to the Church Missionary Society hospital, for treatment.

A small leper colony is maintained at Gedaref which takes those lepers for whom it is impossible or undesirable to arrange home isolation.

CENTRAL SUDAN.

The incidence of leprosy is heavy among certain tribes, but it is rare among the nomads, whether the Arabs of Kordofan and Kassala or the swamp dwellers of the Upper Nile Province. The Nuba Mountains and the southern part of Blue Nile province are the main endemic areas. The problem has been dealt with here by organising small leper colonies near and under the supervision of dispensaries or hospitals.

These colonies usually have their own gardens, wells and goats or cows and are practically self supporting as regards food. Gardening is found to be an excellent form of occupational therapy.

The lepers are attracted to the colonies by the amenities offered on a purely voluntary basis. There is no compulsion on them to stay and in fact many leave at certain times of the year to cultivate at home, returning when the work is finished. There are at present nine of these colonies in the Nuba Mountains and the same system has been extended this year to the Fung area of the Blue Nile Province, where three colonies have been formed.

SOUTHERN SUDAN.

The incidence of leprosy is very high in many parts of southern Equatoria Province, particularly in the Zande district where large settlements were founded ten years ago and to which all the lepers, found during the frequent routine examination of the whole population for sleeping sickness, were admitted. Later many were discharged and kept under observation.

It was hoped that it would be possible to stamp out leprosy in a generation, but unfortunately this has not proved to be the case as it now appears that it is almost impossible to diagnose leprosy in its earliest stages on routine inspections. It is significant that 158 fresh cases were diagnosed in this area in 1938.

Although the big settlements at Li Rangu and Source Yubu have served and are serving a most useful purpose it is considered that the most effective way of dealing with leprosy in other parts of this area is through the native administrations.

A scheme is at present being worked out for the chiefs to be responsible for maintaining small leper colonies in their areas supervised by the nearest dispensary and for assisting the medical staff in the periodic inspections.

In this way, by encouraging the native authorities to take an interest in the disease and to accept responsibility for the measures required to deal with it, it is hoped to educate the people as regards its prevention and cure so that they themselves will take a more active part in dealing with it in future.

Any such scheme will have to be introduced slowly and with great care under constant supervision.

GENERAL.

Experience in the Sudan and elsewhere has shown that there is no means of rapidly eliminating this disease either by cure or prevention and it appears that it will only be finally dealt with by a general raising of the standard of living. Consequently any drastic measures such as compulsory isolation in leper colonies are unjustified and have in fact done harm in the past by antagonising the people, with the result that cases in the early infectious stage were hidden. Further the amount of money that should be spent in dealing with this disease must be assessed in relation to the results obtainable, as the limited funds available might often be spent to better advantage in combating other endemic diseases more amenable to treatment and prevention, or in general public health/improvement.

EQUATORIA PROVINCE.

LEPER CAMPS AND SETTLEMENTS.

District	Station	Remaining on 1.1.38	Admitted	Re-Admitted	Discharged	Left the settlement	Died	Remaining on 1.1.39
Juba	Toliang	19	3	—	7	3	—	12
	Koggi	41	7	—	1	—	4	43
Torit	Torit	—	7	—	1	4	—	2
	Loa	10	5	35	—	40	1	9
	Opari	10	—	21	—	27	2	2
Yei...	Yei	35	—	—	—	3	2	30
	Kajo-Kaji	55	10	—	1	9	5	50
Lakes	Rumbek	40	25	—	10	—	4	51
Western	Wau	35	27	—	5	—	5	52
Zande	Li Rangu	1,202	72	411	471	14	23	1,177
	Yubu	352	4	—	44	59	13	240
	Meridi	89	2	16	4	—	7	96
TOTAL	...	1,888	162	483	544	159	66	1,764

Medical Officer, Yei, has carried out excellent intensive work in raising the standards of Yei and Kajo-Kaji leper camps by improving housing and water supplies, and increasing cultivation and planting trees. The morale of the patients has shown a corresponding improvement.

Zande District. Li Rangu Settlement. 72 cases were admitted during the year, and 86 fresh cases who were non-infective remained in their homes under surveillance.

555 cases who had been discharged in previous years but who were still living in the settlement were re-examined. Of these 342 were finally discharged from the settlement as cured or burnt out, and 213 were readmitted for further observation.

There were 1,177 cases in the settlement at the end of the year of whom 162 were segregated.

During the last four months of the year hydnocarpus oil by injection was adopted as the standard treatment.

The following is the classification of all cases at present in the settlement :—

N1		N2		N3		C1		C2		C3		Arrested		Cured	
M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
192	125	120	76	36	20	91	40	77	28	27	15	105	64	34	29

Yubu Settlement. A large part of the settlement has been resited and it now covers an adequate area. The lepers are comfortably settled in an accessible site well isolated from the remainder of the colony.

There were 240 lepers in the settlement at the end of the year of whom 60 were segregated.

MALARIA.

11,573 cases were admitted to hospital with 84 deaths compared with 7,983 cases and 39 deaths in 1937.

This disease remains the principal cause of sickness and hospitalisation in the Sudan.

BLUE NILE PROVINCE.

The incidence in Wad Medani and the Gezira showed a considerable increase compared with 1937 owing to the very heavy, badly spaced rainfall in the autumn.

GEZIRA AREA	1937		1938	
	Cases	Deaths	Cases	Deaths
Hospital inpatients	1,111	—	2,042	7
Hospital outpatients	3,095	—	11,056	—
Dispensary outpatients	17,422	—	43,560	—

Malignant Tertian is the prevailing infection and the figures of the various types found on microscopic examination were as follows :—

<i>Malignant Tertian.</i>	<i>Benign Tertian.</i>	<i>Quartan.</i>
2,757	863	188

The incidence was above average at Sennar but showed a considerable decline in Singa and Roseires. The heavy rains resulted in a heavy incidence in the White Nile Sub-province.

NORTHERN PROVINCE.

The incidence of malaria remained remarkably low in the northern part of this Province. In the south, however, in the Berber and Shendi districts there were two small outbreaks owing to the exceptionally high Nile and flooding in the surrounding basins.

KORDOFAN PROVINCE.

The incidence was above average owing to exceptionally heavy rainfall in July and August. The rural districts suffered most except in eastern Kordofan where dispensaries reported a decrease.

KASSALA PROVINCE.

Owing to heavy rains and a high Gash flood, which broke its banks, the incidence of malaria in Kassala district was heavier than usual.

In Gedaref where the rains were average a decline in incidence was reported.

GENERAL.

As regards the northern Sudan, the recent organisation of mosquito brigades to work in the more populous areas in the northern riverain province has been effective in reducing the incidence of the disease and it is hoped will prevent the extensive epidemics which have always occurred periodically in this area.

In the Blue Nile Province, the anti-malarial measures are being constantly improved in the Gezira as a result of experience and by practical application of the results of the investigations carried out by the Malariologist. Investigations are at present being carried out in the White Nile area to decide the most effective measures to deal with the many difficult malaria problems which the filling of the reservoir will create.

Mosquito brigades have been strengthened in many towns in the central and southern Sudan, but the population as a whole live under conditions which do not permit of the disease being dealt with effectively by this method and the encouragement of the use of mosquito nets and insecticide, the provision of as adequate facilities for treatment as possible, and the destruction of breeding places of mosquitoes, where possible, are the principal lines of attack.

The following table shows the spleen rate of children examined in the intermediate and village schools during the last three years. In the northern Sudan these figures provide a fairly accurate index of the endemicity of malaria but in the southern provinces of Equatoria and Upper Nile, where schools are few and where the children examined are to some extent living under protected conditions the spleen rate does not indicate the incidence of malaria which is high throughout the area :—

% SPLEEN RATE			PROVINCE & DISTRICT	TYPE OF PARASITE, 1938		
1936	1937	1938		% Benign	% Malignant	% Quartan
			NORTHERN PROVINCE.			
0.7	7.8	3.9	Wadi Halfa	43.7	56.3	—
16.1	16.8	15.6	Dongola	70.3	28.0	1.7
14.0	13.2	13.2	Berber	23.5	76.5	—
2.7	2.7	2.5	KHARTOUM PROVINCE.	20.3	79.3	0.4
			KASSALA PROVINCE.			
1.6	10.1	8.5	Port Sudan	43.6	45.1	11.3
23.7	27.8	22.7	Kassala	64.9	33.2	1.9
			BLUE NILE PROVINCE.			
19.4	16.6	25.9	Gezira	22.6	72.4	5.0
47.2	46.9	50.3	Fung	18.2	81.2	0.6
37.4	29.0	44.7	White Nile	20.7	79.0	0.3
35.8	46.9	50.1	DARFUR PROVINCE. ...	30.3	69.6	0.1
41.1	32.2	44.1	KORDOFAN PROVINCE.	17.7	81.8	0.5
21.1	17.9	32.1	UPPER NILE PROVINCE.	3.0	94.5	2.5
			EQUATORIA PROVINCE.			
23.5	20.7	22.6	Mongalla	4.9	94.8	0.3
19.4	17.7	*—	Bahr-el-Ghazal ...	46.4	53.6	—

*Schools closed owing to Cerebrospinal Meningitis.

RABIES.

The incidence of this disease remains high.

Year				Number of persons receiving treatment	Deaths despite treatment	Total deaths
1932	...	...	...	226	4	8
1933	...	...	...	75	6	12
1934	...	...	...	198	6	8
1935	...	...	...	290	4	10
1936	...	...	...	373	1	8
1937	...	...	...	534	6	11
1938	...	...	...	557	1	8

Of those treated, 74 had been in contact with rabid animals and 483 actually bitten. The biting animals were as follows :—

Dogs	Donkeys	Cats	Horses	Hyenas	Monkeys	Foxes
464	9	2	3	2	2	1

The following data is available as regards the fatal cases :—

LOCALITY.	Age	Sex	Biting animal	Site of bite	Severity of Bite.	No. of days after bite when treatment was begun	No. of injections given	No. of days from bite to fatal termination.
<i>(a) Those Treated.</i>								
Blue Nile	5	Male	Dog	Thigh	Superficial	Same day	14	30
Blue Nile	60	Male	Dog	Back and Arm	Superficial	Same day	5	52
<i>(b) Those not Treated.</i>								
Kordofan	60	Male	Dog	Upper lip	Deep	—	—	52
"	40	Male	Dog	R. Arm	Superficial	—	—	88
"	8	Female	Dog	R. Arm	Severe	—	—	32
"	12	Female	Dog	Arm	Medium	—	—	40
"	35	Female	Dog	L. Thumb	Superficial	—	5 which were given after symptoms developed	44
Khartoum	10	Male	Dog	R. Check L. Shoulder and wrist	Medium	—	—	21

This disease is endemic throughout the Sudan, and is particularly prevalent in Kassala, Kordofan, and Blue Nile Provinces.

For many years prior to 1924 it was not reported in the Sudan although the disease was said to exist in remote parts of Darfur Province. In that year it was reported from various towns in the northern Sudan and gradually spread over the whole country. It causes much inconvenience and the staff of the Stack Laboratories have to devote much of their time to the production of the large quantities of anti-rabic vaccine required.

Although, by compelling owners to licence dogs at a high yearly fee and continually destroying all stray dogs, it is possible to protect the towns fairly adequately, the problem is far more difficult in the country districts where dogs are regarded as a necessity to protect the villages and to guard the flocks and herds. To add to the difficulties the disease is prevalent among wild animals, notably hyenas and jackals who form a reservoir of the disease which would ensure its survival in the Sudan even if all the dogs were destroyed.

Consequently it is not possible to eliminate the disease and all that can be done is to warn the villagers of its gravity and of the importance of immediate treatment.

Actually the disease is at present more an annoyance than a serious public health problem. The measures in force ensure at any rate that the chances of getting bitten are reduced to a minimum and that as high a proportion as possible of persons bitten are treated with anti-rabic vaccine. As a result the mortality from the disease is fortunately very small but it is only by constant effort that it will be possible to keep the mortality at the present low figure.

ACUTE RHEUMATISM.

292 cases with 4 deaths were reported compared with 274 cases with 2 deaths in 1937 and 288 cases with 5 deaths in 1936.

The distribution of cases was as follows :—

PROVINCE.	Cases.	PROVINCE.	Cases.
Blue Nile	27	Khartoum	11
Darfur	58	Kordofan	56
Equatoria	28	Northern	27
Kassala	79	Upper Nile	6

SCURVY.

84 cases with 5 deaths were reported compared with 19 cases and no deaths in 1937. The majority of cases occurred amongst labourers entering the Gezira irrigated area of the Blue Nile Province, 21 cases imported from Abyssinia being reported from Wad Medani and 41 from Abu Usher, all of whom were natives of West Africa.

SLEEPING SICKNESS.

110 cases were reported compared with 89 in 1937 of which 106 occurred in the eastern Zande district and 4 in the Kajo-Kaji district.

The incidence during the last ten years has been as follows :—

YEAR.	Yubu.	Yambio.	Yei.	Kajo-Kaji.
1929	18	—	—	—
1930	37	1	—	—
1931	61	1	—	—
1932	49	14	—	—
1933	70	12	1	—
1934	20	2	4	6
1935	80	—	1	10
1936	142	—	—	8
1937	63	1	2	23
1938	106	—	—	4

398,798 palpations were carried out during the year and 2,808 gland punctures performed.

The modification in the preventive measures taken against sleeping sickness introduced in 1937, has been found to be satisfactory in practice.

This aimed at relaxing many measures such as very frequent medical inspections and compulsory detention in hospital of cases of sleeping sickness for a long period and enforcing more effectively those measures which it was considered essential to retain under modern conditions.

In addition, special attention was paid to the elimination of fly from stretches of river by extensive block clearing and systematic catching of fly between blocks. This method was recommended by Mr. C. B. Symes, Medical Entomologist of the Kenya Medical Service, who spent a month in the Province at the end of 1937 advising the local medical authorities on the subject. Some 60 fly boys were engaged during the year in fly catching, under the supervision of two sanitary overseers, along a stretch of 14 miles of the River Yubu, blocked in seven mile lengths. Most of the cases reported during the last two years had been infected in this area.

A stretch of infected river was similarly dealt with in the Kajo-Kaji area of Yei district.

An additional Assistant District Commissioner was appointed at the end of 1937 to supervise the native authorities in the Yubu district in carrying out their administrative duties in connection with the sleeping sickness campaign and so ensure that such measures as the routine medical inspections of the population were properly attended, the clearing of watering places properly carried out and the official watering places used by the people.

EQUATORIA PROVINCE.

Yei District. Four cases were detected in the Kajo-Kaji area in 1938 compared with 23 in 1937, and none in Yei where two cases had been reported the previous year.

The following special precautionary measures were taken:—

- (a) Fly catching between block clearings which has proved remarkably successful in this area.
- (b) Extensive clearing of watering places.
- (c) Prophylaxis with Bayer 205.
- (d) Periodic inspections of all people returning from Uganda and Belgian Congo.

48,261 tsetse flies were caught during the year.

Routine sleeping sickness inspections in this area have been carried out successfully by the native administration in certain areas and it is hoped that the chiefs will be able to supervise all the sleeping sickness inspections in the Kajo-Kaji sub-district next year. Chiefs with subordinate native administration and medical staff have been given special instruction for this purpose.

The sleeping sickness pass system with Uganda is working well in this district.

Zande District. 106 cases of sleeping sickness were detected at Yubu compared with 63 in 1937. The increase in the number of cases is due to a fresh outbreak at Baragu and to a higher incidence in the area previously

infected owing to the activity of the chilli trade. This results in the majority of the population making prolonged excursions into the bush. Senior Medical Inspector Yubu reports that traffic with the infected river system is facilitated by the network of paths which have to be cut for fly catching operations.

He also suggests that the percentage of infected fly has probably risen due to the increased number of human carriers resulting from less frequent sleeping sickness inspections.

The block clearing method of tsetse fly elimination has been carried out along 25 miles of the River Yubu from its source to Tembura.

Two sanitary overseers, eight head fly boys and 50 fly boys were employed. The length of paths cut through the bush totals about 190 miles. 33,956 tsetse fly were caught during the year and the density of the fly already shows a decrease.

Sleeping sickness inspections have been carried out in Chief Dika's country by local Zande staff alone with satisfactory results.

During the year the administrative authorities practically completed the new census in the form of a card index system.

Dr. Hunt, Senior Medical Inspector, Yubu, summarises the situation as follows :—

- (1) The only aspect of the increase in number of sleeping sickness cases this year which gives rise to concern is the outbreak in Hiriwe's country and steps are being taken to deal with this by the " prophylactic Bayer " method.
- (2) The situation in Renzi's country remains much as it has been on and off for many years. The disease is endemic in this fly-infested region and our present organisation and methods of control can hope for no more than to keep the disease in check.
- (3) Eradication of the disease in Renzi's country (if it be possible) demands an entirely new line of attack. Experiments on these lines are now being conducted in the shape of attempted fly elimination by the " Block " method. It is yet too early to form conclusions as to the efficacy of this method, but this year has seen the scheme well started, clearing operations completed in Blocks I and II, a fairly large staff of fly boys recruited and trained, and already an apparent decrease in the fly population. If this experiment is going to be a success we should begin to see definite results towards the end of 1939.
- (4) Control of sleeping sickness by the " prophylactic Bayer " method has not been previously tried out in this country and the results of the application of this method to Baragu in Hiriwe's country will be watched and studied with the greatest interest.
- (5) So long as the majority of sleeping sickness cases continue to be detected in the early stages, the prognosis with the present methods of treatment is excellent.

TUBERCULOSIS.

1,027 cases were admitted to hospital of whom 623 were pulmonary and 404 non-pulmonary.

The figures for the past year show an increase which may be partly accounted for by the heavy incidence of malaria. But apart from this, with increasing contact with the outside world, a rise in incidence of tuberculosis is to be anticipated. The disease continues to be a serious problem in certain districts. In the Wadi Halfa and Dongola districts of the Northern Province the incidence is higher than in the remainder of the Sudan, owing partly to local conditions and partly to the return of infected residents from Egypt where the climate and conditions of work predispose them to the disease. Attempts are being made by home visiting to examine and re-examine house contacts and to follow up cases after discharge from hospital.

Taking the Sudan as a whole it is hoped that the steady rise in the standard of living which has taken place during the last twelve years may counterbalance the increased risk of infection from outside the Sudan.

40 of the pulmonary cases were foreigners and 19 were Sudanese who had contracted the disease in Egypt. The nationality of foreigners affected was as follows :—

	Pulmonary	Non-Pulmonary		Pulmonary	Non-Pulmonary
West Africans ...	12	15		35	26
Egyptians ...	9	2	Yemenis ...	3	1
Eritreans ...	7	8	Somalis ...	1	—
Abyssinians ...	7	1	Hadramuti ...	1	—
	35	26		40	27

The following table shows the admissions and percentage rate of tuberculosis to other admissions for the northern and southern Sudan for the last four years :—

	1935		1936		1937		1938	
	Pulmonary.	Non-Pulmonary.	Pulmonary.	Non-Pulmonary.	Pulmonary.	Non-Pulmonary.	Pulmonary.	Non-Pulmonary.
NORTHERN SUDAN.								
Admissions for TB	415	302	451	313	418	331	550	336
Total admissions	58,445		65,392		66,881		67,622	
%TB to total adms.	0.71	0.51	0.69	0.47	0.62	0.49	0.81	0.49
	1.22%		1.16%		1.11%		1.30%	
SOUTHERN SUDAN.								
Admissions for TB	86	69	68	36	70	64	73	68
Total admissions...	30,638		30,689		34,207		36,744	
%TB to total adms.	0.28	0.22	0.22	0.11	0.20	0.19	0.20	0.18
	0.50%		0.33%		0.39%		0.38%	

The following table shows the admissions for pulmonary and non-pulmonary tuberculosis in the last ten years and the percentage rate of tuberculosis to other admissions :—

YEAR.	Pulmonary.		Non-Pulmonary.		Total.	
	Admissions.	Percentage.	Admissions.	Percentage.	Admissions.	Percentage.
1929 ...	302	0.65	322	0.70	624	1.35
1930 ...	480	0.95	300	0.61	780	1.56
1931 ...	390	0.65	294	0.49	684	1.14
1932 ...	421	0.70	281	0.47	702	1.17
1933 ...	521	0.74	394	0.56	915	1.30
1934 ...	557	0.65	437	0.50	994	1.15
1935 ...	501	0.56	371	0.42	872	0.98
1936 ...	519	0.54	349	0.36	868	0.90
1937 ...	488	0.48	395	0.39	883	0.87
1988 ...	623	0.59	404	0.39	1,027	0.98

Pulmonary Tuberculosis.

Comparative table shewing the occupation of persons affected with pulmonary tuberculosis in the northern Sudan during the last five years :—

OCCUPATION.		Cultivators	Nomads	Soldiers Sailors and Police	Day Labourers	Townsmen			Indigent and unemployed	Women not employed	Children	Total
						Artisans, and Shop- keepers	Clerical	Servants				
1934 ...	...	124	25	5	57	110	—	—	47	79	5	452
1935 ...	...	113	15	9	43	94	—	—	51	87	3	415
1936 ...	...	104	8	14	53	99	—	—	73	96	4	451
1937 ...	...	117	5	19	73	47	26	12	72	107	10	488
1933 ...	...	135	—	17	97	61	19	18	86	115	2	550

Age Incidence.

The following table shows the incidence of cases and deaths by age from pulmonary tuberculosis :—

Age Periods	0-1		1-5		5-15		15-25		25-35		35-45		45-65		65 and over		TOTAL.	
	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D
Northern Sudan	—	—	1	—	4	—	108	19	213	45	140	23	69	13	15	4	550	10
Southern Sudan	—	—	—	—	2	—	20	6	26	6	17	6	6	4	2	2	73	24

NON-PULMONARY TUBERCULOSIS.

Admissions for non-pulmonary tuberculosis were classified as follows :—

			Gland	Bone	Joint	Other	Total
Northern Sudan	...	...	166	80	32	58	336
Southern Sudan	...	...	14	24	8	22	68

Age groups were as follows :—

		0-1	1-5	5-15	15-25	25-35	35-45	45-65	65 & over
Northern Sudan	...	—	8	26	79	115	74	31	3
Southern Sudan	...	—	3	9	15	26	9	6	—

TUMOURS.

641 cases were admitted, classified as follows :—

Malignant	{	Carcinoma	131						
		Sarcoma	48	...	...	...	...	...	196
		Unclassified	17						
Benign		...	...	...	...	...	...	...	445

The following are the comparative figures for the northern and southern Sudan shown as a percentage of total admissions for the last four years :—

	1935		1936		1937		1938	
	Malignant.	Non-Malignant.	Malignant.	Non-Malignant.	Malignant.	Non-Malignant.	Malignant.	Non-Malignant.
NORTHERN SUDAN. Admissions for new growths	137	328	167	315	161	407	166	321
Total admissions ...	58,445		65,392		66,881		67,662	
% of total admissions	0.23	0.56	0.25	0.48	0.24	0.60	0.24	0.47
SOUTHERN SUDAN. Admissions for new growths	32	156	25	251	16	164	30	124
Total admissions ...	30,638		30,689		34,207		36,744	
% of total admissions	0.10	0.51	0.08	0.81	0.04	0.45	0.08	0.34

The incidence by age and sex of the malignant cases was as follows :—

TYPE.			Sex		Age Incidence								
			Male	Fe- male	0-1	1-5	5-15	15-25	25-35	35-45	45-65	Over 65	Un- known
Carcinoma	...	...	68	63	—	1	2	7	10	38	49	18	6
Sarcoma	...	...	34	14	—	3	7	6	11	9	10	2	—
Unclassified	...	...	13	4	—	—	—	2	5	3	2	5	—
TOTAL	...	...	115	81	—	4	9	15	26	50	61	25	6

UNDULANT FEVER.

28 cases with 3 deaths were reported compared with 33 cases and 1 death in 1937 and 58 cases with 4 deaths in 1936.

This disease is probably commoner than the figures indicate particularly in Kassala Province where the people often drink milk without scalding it as is done elsewhere.

VENEREAL DISEASES.

SYPHILIS.

The incidence of syphilis remains high, but fortunately the Sudanese have a considerable racial immunity and the more serious complications are not seen among them. In particular, locomotor ataxia and general paralysis of the insane are very rarely reported. It is the more obvious and irritating skin rashes, bone pains and chancres which cause the sufferers from the disease to seek treatment.

There is evidence that syphilis is not an important factor in causing abortion in the Sudan.

Thus, although the disease is prevalent and much time is spent in dispensaries and hospitals in its treatment, its effect on the public health is less serious than that in more civilised countries.

Every effort is made to ensure that patients complete treatment. Injections of Novarsenobillon are not allowed to be given unless there is some guarantee that the patient will complete the course, as experience in the Sudan, as elsewhere, shows that grave harm may be done by incomplete courses of this drug. For this reason Novarsonobillon is only issued to dispensaries under special safeguards and treatment is usually restricted to bisoxyl which is found to be effective in practice and to have no ill effects if a course is not completed. It has the further advantage that it has not the effect of Novarsenobillon in being a tonic and aphrodisiac, and for this reason it is far less likely to be used unnecessarily for the cure of vague symptoms such as bone pains often invented by the patient.

GONORRHOEA.

This disease is more serious from the public health point of view than syphilis and more difficult to deal with. Treatment is ineffective, at any rate under field conditions, and the Sudanese are apt to look upon the disease as more physiological than pathological and not to report sick until some complication arises. There is reason to believe that the incidence is high in many areas and has a marked adverse effect on the birth rate in the northern Sudan.

In the south the disease is rare in some districts and common in others having a curious irregular distribution, probably because it has been introduced into this part of the country within recent years.

In the southern Sudan as a whole the incidence is considerably less than in the remainder of the country.

GENERAL.

Adequate facilities are available at Port Sudan for the treatment of foreign sailors with venereal diseases in accordance with the requirements of the Brussels Convention.

YAWS.

This disease has been eliminated from the Sudan except for a few remote districts in the south.

The recent extension of the dispensary network to outlying districts in this area will enable the disease to be dealt with effectively and it should soon disappear from the whole country. In the past it was very prevalent throughout Upper Nile and Equatoria Provinces and was the cause of much disability, sickness and hospitalisation.

PUBLIC HEALTH AND HYGIENE.

BY MR. H. A. CROUCH.

INTRODUCTION.

GENERAL HEALTH.

The 1937 harvest was good and grain was plentiful at the beginning of the year. The heavy rains brought good grazing and an abundant supply of those natural salads which form an important part of the diet of the less sophisticated natives. Flood and locusts were responsible for considerable loss in property and crops in several areas, otherwise economic conditions were improved and the people enjoyed a state of reasonable prosperity.

In general the standard of living of the Sudanese is improving steadily year by year and this is particularly noticeable in the provinces of the northern Sudan where the people are far better off than they were ten years ago.

The population is rapidly increasing and though statistics are difficult to obtain in many districts, the numbers of children in the villages provide striking evidence.

Outbreaks of smallpox and relapsing fever occurred in Kassala, Blue Nile, Kordofan and Darfur Provinces and there was a heavier incidence of malaria in most parts of the northern Sudan, otherwise the general health of the people was satisfactory and compared favourably with that of previous years.

GENERAL SANITATION.

This year for the first time opportunity was given to review the more urgent public health requirements of the country as a whole. Five year programmes of improvement were prepared and thus it was possible to assess the relative urgency of province sanitary proposals.

Though in some years funds may be curtailed this method ensures that improvement is uniformly distributed and steadily maintained.

This year the bulk of the funds provided were allotted to the general improvement and augmentation of sanitary services, to the clearing of insanitary areas, and to the extension of anti-mosquito measures.

THE PREVENTION OF DISEASE.

The outbreak of smallpox which has persisted in the eastern and central provinces of the Sudan during the past three years illustrates the difficulties encountered in the control of epidemic disease along an extensive land frontier and in a country where there is a constant traffic of wandering homeless natives over many and devious routes.

The disease was introduced in 1936 by West African labourers returning from Eritrea and Abyssinia. Since then there has been a constant stream of infection over the border and the disease has spread from Kassala and the

eastern districts of the Blue Nile Province, through the Gezira irrigated area, to Kordofan and Darfur Provinces. Many of these labourers cross the border during the incubation period and develop the disease en route to the west.

Vaccination has been carried out vigorously in all infected areas. Immigrants, as far as possible, have been rounded up and vaccinated at centres along the eastern border and on the main routes. All fourth class passengers on west-bound trains have been vaccinated at Gedaref and trains searched at Sennar for any missed cases. Motor traffic has been similarly controlled.

As a result of these measures the disease died down towards the end of the year, but reappeared in Darfur Province where pilgrims proceeding eastwards introduced the disease from French Equatorial Africa. The disease remained sporadic. A vaccination campaign was organised to vaccinate the whole of Darfur Province and is still in progress.

Since the beginning of the outbreak in 1936 1,410 cases and 346 deaths have occurred in the four provinces infected. During this period 1,783,631 persons have been vaccinated. The total population of the four provinces is estimated at 3,118,353 so that more than half the population at risk is protected. In this connection, however, it must be remembered that the population to a large extent is a floating one and while it is reasonable to suppose that the bulk of the sedentary population is now protected, there is a constant influx of susceptibles from east and west. Even so, smallpox is unlikely to reach epidemic proportions in this area for some years to come.

The epidemic of relapsing fever which ravaged the western provinces during the years 1926-1930 extended eastwards as far as the Blue Nile Province where it decreased in virulence and finally died out in 1932. The Sudan was free of the disease during the following three years. In 1936 the disease was introduced from Abyssinia into the Singa district of the Blue Nile Province but remained localised and was stamped out. In 1937 further cases occurred in the Gezira area, Khartoum, Kordofan, and Darfur Provinces and during the past year cases have continued to occur in these provinces. The disease has not at any time reached epidemic proportions, but only by a widespread delousing campaign, and early treatment of cases has it been possible to keep the disease under control. During the present outbreak, in three years there have been 1,520 cases with 164 deaths, a mortality rate of 10.7%. 125,381 persons have been deloused. The origin, method of spread, and measures of control are similar to those described under smallpox. Unfortunately the means at our disposal for stamping out relapsing fever are not as reliable or as easily applied as those employed in the control of smallpox. The disease is mild and there are many ambulant cases and carriers. A person may be deloused while incubating the disease and later infect a new generation of lice. The disease may thus become endemic and extremely difficult to eradicate.

The extensive epidemics of cerebrospinal fever which have been responsible for so much loss of life in the central Sudan during the past few years, appear to have died down and only sporadic cases have been reported during the past year.

The situation as regards endemic disease has not changed materially during the year. The incidence of bilharzia, leprosy, tuberculosis, sleeping-sickness and dysentery remain about the same. Hookworm and guinea worm continue to be major public health problems in the south. There has been some increase in the incidence of enteric fever and the endemic area of kala-azar is more widespread than supposed. Hitherto, where control measures are practicable steady progress has been maintained and the spread of endemic disease checked. Permanent improvement necessarily depends on a general betterment in the diet, housing and living conditions of the people.

THE CONTROL OF MALARIA.

The 1938 rains were exceptionally heavy and badly spaced and the river reached a record flood level. The malarial relapse rate during the earlier months of the year had been higher than usual in several areas. The combination of these factors resulted in a very considerable rise in the incidence of malaria in most parts of the northern and central Sudan.

The conditions in and around Khartoum were unprecedented. The City was surrounded by a vast grass-grown lake, unapproachable except from the air and impossible to control. Mosquitoes bred out freely and were carried into the city in waves by the south wind.

In the Northern Province basins were flooded, and in Kassala Province the River Gash burst its banks in several places. Elsewhere large areas were inundated and sheets of water persisted in some places until the end of the year.

In such circumstances the usual methods of mosquito control break down. It is still possible to control effectively mosquito breeding in towns but there is no means of preventing the infiltration of adults from large and uncontrollable breeding places in the vicinity. In these circumstances both in urban and rural areas protection of the individual must be the principal measure of defence. Throughout the malarial season householders were urged to use mosquito nets and spray their houses with insecticide. In Khartoum public health staff were permanently employed in daily visits to houses, counting the mosquitoes found and thoroughly spraying all rooms and outbuildings.

There is no doubt that these methods proved of great value in this most difficult year.

In general, anti-mosquito work has been carried out along the same lines as in the past. Mosquito brigades have been strengthened in many of the towns and controlled areas extended.

The Medical Entomologist has continued his study of the bionomics and breeding places of the vector in the Gezira and in Khartoum and already investigations have resulted in increased efficiency and economy in control measures.

Recent studies of the Garmut fish suggest a method of biological control which should prove of great value in the destruction of mosquito larvae in wells and tanks inaccessible or unsuited to the more usual methods. These fish are easily obtainable in pools left by the falling river, they can live in water containing little oxygen and devour mosquito larvae at the rate of several thousand in a single night.

WATER SUPPLIES.

During the year the Khartoum City water supply was extended to parts of Khartoum North where 54 wells were closed. 85 samples of the piped supply in the Three Towns were analysed and reported satisfactory.

A purification plant and piped supply was installed at Wadi Halfa and work commenced on the construction of a similar plant for Malakal town.

At Atbara an additional settling and chlorinating plant was installed.

Most of the larger towns in the Sudan are now provided for and pure water supplies are now available at Khartoum, Khartoum North, Omdurman, Atbara, Wadi Halfa, Port Sudan, Wad Medani, Abu Usher, Meringan, Barakat,

El Obeid and Juba. The Egyptian Irrigation colonies at Malakal, Gebel Aulia, and Gordon's Tree Dockyard are similarly provided for.

Drinking water for the pilgrim quarantine at Suakin is supplied from condensers.

All these supplies have been analysed on one or more occasions during the past year and reported on favourably.

A scheme is under consideration for the provision of a piped supply for Kassala. At present this thickly populated town draws its drinking water from a large number of wells. This source of supply is not without danger of contamination as the subsoil water is comparatively near the surface and a number of pit latrines still exist in the area.

Elsewhere in the Sudan the natives obtain their water mainly from the rivers and from wells. In certain districts use is made of natural or artificial pools filled by rainwater. When these commence to dry up they become grossly contaminated by man and beast, and are a potential source of infection by bowel organisms and bilharzia.

In the Gezira irrigated area villagers draw their water from neighbouring canals. During the "close down" season the water in minor canals becomes stagnant and polluted. The problem is being dealt with either by fencing a length of the canal and piping the water to a tank and rotary pump or by the provision of conveniently sited wells.

Elsewhere efforts are being continued to render natural supplies as safe as possible; in the case of rivers, by the cleansing of the foreshore and the reservation of specified areas for the purposes of drinking, animal watering and ablutions, in the case of wells by the provision of permanent hoists, covers, lips and permanent drain-aways.

AEDES AEGYPTI SURVEY.

The network of subordinate public health officials recently organised throughout the Sudan has enabled inspections to be made over a wide area, and far more accurate information regarding *Aedes* incidence and distribution is now available. Weekly and where possible, more frequent inspections have been carried out in towns and all buildings, wells, pools, boats, tree holes and other likely breeding places are examined regularly.

Experience in the Sudan has shown that in order to obtain accurate information, identification must be carried out in every case by an expert entomologist. All larvae are bred out locally and sent to the Medical Entomologist who identifies them personally.

During the past year 5,467,553 inspections were carried out and 2,817 collections of mosquitoes were despatched by the local public health authorities as probable *Aedes aegypti* infections. 125 of these were confirmed.

There has been a considerable reduction in incidence throughout the Sudan particularly in towns on the main air routes and in Port Sudan.

Special attention of course has been paid to air routes, elsewhere the reduction is due to stricter house-to-house inspections.

At Juba in Equatoria Province 13 infections were found in trees. These tree infections give an immense amount of trouble. Five men are employed solely on tree inspection and repair work and in the course of the year 4,572 tree holes were filled with cement. On one occasion a paw-paw tree with two feet of water in its hollow trunk was found to be swarming with *Aedes* larvae.

The Medical Entomologist identified 1,861 specimens of *Aedes aegypti* in 125 collections during the year. In addition 421 specimens of *Aedes vittatus* were identified, a cause of error in the past. Two collections of *Aedes metallicus* were found in Khartoum during the rainy season.

SANITARY CONTROL OF AIRCRAFT.

Inspection and disinsectisation of aircraft has now been centralised on Khartoum, except in cases where aircraft make a night stop at an airport near the frontier. On the west to east route these measures are carried out at Geneina and again at Khartoum. All passengers entering the Sudan from the west must be in possession of a certificate stating they have not been exposed to the risk of infection by yellow fever during the previous six days.

The following inspections were carried out during the year :—

Khartoum	...	...	...	830	Juba	...	...	...	...	110
Halfa	...	...	...	650	Geneina	...	...	...	...	202
Malakal	...	...	...	502	Kassala	...	...	...	...	80
TOTAL				...	...	...	...	...	...	2,374

At Khartoum 16 mosquitoes were found on aircraft from the south and 1 from the east. All were culex.

In addition 480 *Musca domestica* and primivera and 125 May flies and chironomids were captured and identified.

At Kassala there were 11 infestations found on westbound aircraft, 10 of these were culex, 1 anopheline.

Elsewhere no mosquitoes were found on inspection except at Juba where one anopheline and 7 culex were found on a northbound aircraft which had remained overnight on the aerodrome.

At Geneina seven passengers failed to produce certificates of freedom from exposure to the risk of infection by yellow fever, and were quarantined either at Geneina or Khartoum.

HOUSING.

In 1937 a central committee was established in Khartoum to advise on the general question of native housing. The functions of this committee are to collect and collate opinions of province officials on the accommodation, layout and construction of native houses, and to evolve model types which meet the local needs and prejudices of the native population and at the same time satisfy public health and economic requirements.

Considerable progress on these lines has been made during the past year. Plans of various types of houses have been drawn up and circulated, models prepared and exhibited, and demonstration houses erected in Khartoum and other province headquarters.

In addition, the housing accommodation and amenities required for various grades of native officials have been standardized.

From the point of view of native housing the Sudan may be divided roughly into three areas.

The northern area where the rainfall is scanty and where the flat roofed mud brick house prevails.

The southern area of heavy rainfall where grass and timber are abundant and where the thatched hut is almost universal.

The central area of medium rainfall where the above two types of housing tend to merge and where building material is scarce and costly.

In the northern area the type of house built, when of adequate dimensions and if properly maintained provides accommodation of a fairly satisfactory standard. In the towns there is a growing tendency to build in red brick and in some instances this example has been followed in the larger villages.

Planning of the larger towns in the northern Sudan has been reviewed recently and slum clearance carried out on a large scale at Wadi Halfa and at other important centres. Where new lodging areas have been allotted, due attention has been paid to a proper layout with wide streets, open spaces and the construction of an improved type of dwelling.

In the southern area efforts are being made to increase the size and ventilation of huts and to introduce mosquito wire where practical. New pattern, screened houses have been provided for native officials at Juba and Singa. The beneficial effect is reflected in the lowered incidence of malaria amongst these officials.

It is in the central belt where the need for housing improvement is most marked. In this area the rainfall is sufficient to render the maintenance of mud buildings costly and grass and timber is scarce. In an attempt to solve the problem the committee have evolved a house of the "Dahr El Tor" type in mud brick with sloping thatched roof and low eaves. A feature of the construction is that the timber for the roof, doors, and windows can be turned out by mass production and at a cheap rate by the saw mills operating in this area. Arrangements are being made for facilitating the provision of bamboo poles and grass for thatching and various methods for the protection of mud brick and the hardening of floors are under consideration.

NUTRITION.

There has been no serious lack of bulk food supplies during the past year. The 1937 harvest was good and adequate supplies of grain were available in most areas. This year flooding and locusts have been responsible for considerable destruction of crops and a shortage of grain is anticipated.

As in the past few cases of gross nutritional deficiency are reported. At Kosti a number of cases of scurvy occurred amongst nomad Arabs and western immigrants. All improved rapidly on an anti-scorbutic diet. At Kassala three cases of scurvy and one of pellagra were diagnosed amongst labourers returning from Eritrea. In addition many were suffering from malnutrition which manifested itself in various forms, mostly in skin ulceration and bone necrosis following slight degrees of trauma. At El Obeid a mild outbreak of glossitis occurred in the prison. The cases appeared to resemble the glossitis described as a symptom of pellagra. The examination of 40,340 school children revealed no evidence of nutritional deficiency.

Notwithstanding, in the opinion of the local medical authorities a state of sub-nutrition exists in many areas. Certainly in most places there is a lack of variation in diet and by European standards most native diets are deficient in animal protein, minerals and vitamins.

During the past year a questionnaire has been sent out to administrative officials with a view to obtaining a fuller and more accurate knowledge of the nature and quantities of the diets consumed by the various tribes; meanwhile by means of demonstration and propaganda the people are being encouraged to grow more vegetables and fruit and to improve their milk supplies. Methods of preserving meat for distribution among the fly infested areas of the south are being enquired into.

STAFF.

The establishment and distribution of 12 British Sanitary inspectors remains the same as last year.

Two Sudanese sanitary officers passed the examination of the Royal Sanitary Institute in November, making a total of 11 in this cadre since its institution in 1934.

A sanitary officer is now posted to every province where British staff is not available.

The establishment of 62 posts for sanitary overseers is now almost complete in the northern Sudan. 10 house-to-house inspectors passed the qualifying examination during the year.

In the south, of seven trainees who had completed their first year of training at Juba five passed the local examination and were posted to districts.

THE HEALTH AND SANITATION OF PROVINCES.

KHARTOUM PROVINCE

Area—5,700 square miles. Population 252,395.

General.

The rainfall was heavy and the rivers high ; mosquitoes bred freely in the second half of the year and were followed by a rapid spread of malaria among a relatively susceptible people.

Vital Statistics.

The figures presented below do not elaim to be exact ; they provide, however, a useful year-to-year comparison.

Population.

The following table gives the estimated population of the Province and of its four districts for the years 1937 and 1938 :—

				Men	Women	Children	Total
(a) Khartoum	...	...	1938	16,017	13,434	15,218	44,669
			1937	15,826	13,589	15,095	44,510
(b) Khartoum North	...	...	1938	5,191	4,515	5,057	15,063
			1937	4,760	4,522	5,711	15,013
(c) Omdurman	...	...	1938	28,619	37,147	50,430	116,196
			1937	27,851	36,892	49,714	114,457
(d) Rural District	...	...	1938	20,739	20,229	35,499	76,467
			1937	20,276	26,877	34,033	81,186
(e) For the whole Province	...		1938	70,566	75,625	106,204	252,395
			1937	68,733	81,880	114,553	255,166

The only conspicuous change in these figures is the drop of some 6,600 in the number of women living in the Rural District. There is no obvious explanation other than a difference in the counting and estimation.

The following table gives the population by race for the years 1937 and 1938.

	British	Greek.	Other Europeans	Egyptians and Syrians	Native of the Sudan.	All Others.
1937 ...	763	1,699	960	5,649	244,669	1,426
1938 ...	800	1,481	240	5,482	242,451	1,941

The following figures are not included in the tables above :—

Average Strength :

British Troops	...	...	...	...	...	1,236
Sudan Defence Force Troops	...	...	...	...	...	918
Central Prison	...	...	...	...	...	387

Births and Deaths.

The registered births were 4,617 or 343 more than in 1937 and the deaths 3,111 or 657 more than in 1937.

The excess of births over deaths was 1,506 giving a natural increase rate of 6 per 1,000 living as compared with 7.2 in 1937 and 6 in 1936.

In the following tables births are live births only.

By Race and Sex :—

	Race	Male	Female	Total
(a) British	5	3	8
(b) Greek	11	5	16
(c) Other Europeans	6	5	11
(d) Egyptians and Syrians	124	109	233
(e) Natives of the Sudan	2,229	2,077	4,306
(f) All others	23	20	43

These figures yield the following rates for those settled in the Province :—

	1938	1937
(1) Egyptians and Syrians	42.3	35.8
(2) Natives of the Sudan	17.8	16.4

Birth rate by Localities.

Khartoum	...	...	1937	22.3	Omdurman	...	...	1937	17
			1938	22.1				1938	16.7
Khartoum North	...	...	1937	33.9	Rural District...	...	...	1937	13
			1938	38.2				1938	14.5
The whole Province	...	...	1937	16.8					
			1938	18.3					

The number of births in both Omdurman and Khartoum North must be fairly accurate as the births are notified by trained licensed midwives.

The great difference in the birth rates of the two towns is then probably due to faulty population estimation as it is most unlikely that this difference is real.

The still birth rate for the Province was 24.3 as compared with 24 in 1937. These rates are very low (that for England and Wales in 1930 was 41 per 1,000 births) and probably many still births are not yet notified.

Death Rate by Localities.

Khartoum ...	...	1937	12.5	Omdurman ...	...	1937	10.4
		1938	16.0			1938	12.8
Khartoum North ...	...	1937	19.5	Rural District ...	...	1937	5.0
		1938	23.3			1938	7.3
The whole Province ...				...	...	1937	9.7
						1938	12.3

The number of deaths registered is higher than in 1937 for each sex in every district, except Khartoum North, where the registered number of deaths among females is lower than in 1937.

The highest death rate is that of Khartoum North where the figure is 23.3 and is about that of England and Wales in 1870-1880.

The death rate in Natives of the Sudan was 12% as compared with 9.6 in 1937.

Seasonal Death Rate.

Figures show the number of deaths in both sexes to be higher—as compared with 1937—from March onwards. In August and September, when intestinal diseases and malaria swept through the Province, the number of deaths notified is double that of those two months in 1937.

Deaths by Age Periods.

			0-1	1-5	5-10	10-20	20-40	40-60	Over 60
Deaths	...	...	323	767	116	149	398	288	1,070
Percentage	...	...	14.1	15.5	2.3	3.3	15.3	12	37.5
		1938	10.4	24.6	3.7	4.8	12.8	9.3	34.4
Percentage England									
and Wales	...	1936	7.1	2.5	1.2	2.1	8.0	19.2	59.9

This table shows that in 1938 one quarter of the deaths took place in the age period 1-5 years. (In England and Wales about 2.5% of the deaths occur in this age period).

This is a very high proportion even when it is known that the second year of life usually shows the greatest degree of annual variation and is probably the age of greatest susceptibility to environment.

There were in fact 387 more deaths among these children than in 1937. Taking the number of deaths at all ages for both these years, we find there were 657 more in 1938 and this increase is more than half accounted for by the 387 deaths which occurred in the age group 1-5 years.

Of the total of 767 deaths in the age group 1-5 it was found possible to make an analysis of the principal causes of death in 634 cases, viz :—

(1) Diarrhoea, Dysenteries and Gastro-Enteritis	...	304	or	47.9%
(2) Pneumonia and Bronchitis	...	161	or	25.4%
(3) " Fever " (probably mostly malaria)	...	107	or	16.9%
(4) Whooping Cough	...	10	or	1.6%
(5) Various (unclassified)	...	52	or	8.2%

It will be seen that the three first causes account for 90% of the deaths and that the diarrhoeas, dysenteries and gastro-enteritis—that may be described as “dirt diseases” and are considered to be partly preventable—for nearly half.

Infant Mortality Rate.	1938	1937
(a) Khartoum	78	76.5
(b) Khartoum North	71	102
(c) Omdurman	92	94

These figures are interesting in that they show such a low rate for Khartoum North, but as the number of births rose from 509 in 1937 to 575 in 1938, and as the number of deaths is small, this rate may not give a true picture.

Certification of Causes of Death.

In the following tables the cause of death was certified by a medical practitioner.

DISEASE.	No. of Cases.	Percentage.	
		1938	1937
(1) Pneumonia	170	24.0%	22.0
(2) Dysenteries and Diarrhoea	120	17.0%	11.0
(3) Heart Disease	58	8.0%	16.0
(4) Violence	57	8.0%	7.0
(5) Tuberculosis	42	6.0%	7.0
(6) Septic Conditions	36		
(7) Old Age	27		
(8) Kidney Disease	26		
(9) Malignant Disease	23		
(10) Pyrexia of uncertain origin	18		
(11) Cerebral Haemorrhage	17		
(12) Difficult Labour and complications of pregnancy	15		
(13) Typhoid fever	12		
(14) { Meningitis	9		
{ Diabetes	9		
(16) Malaria	8		
(17) { Intestinal Obstruction	7		
{ Syphilis	7		
(19) Diphtheria	6		
(20) Leprosy	5		
{ Kala Azar	4		
(21) { Pertussis	4		
{ Blackwater Fever	4		
{ Jaundice	2		
(24) { Asthma	2		
{ Gastric Ulcer	2		
{ Measles	2		
{ Appendicitis	1		
(28) { Relapsing Fever	1		
{ Madura	1		

The first four causes of death in this table are the same as those of 1937 and, indeed, the two tables much resemble one another.

Pneumonia still heads the list, accounting for 25.6% of these deaths, (pneumonia, bronchitis and other respiratory diseases form about 10% of the deaths in England and Wales).

In 1938 pneumonia appeared as a cause of death throughout the year.

The increase in deaths due to the dysenteries and diarrhoea was probably due to the high rainfall and presence of flies.

Heart disease caused fewer deaths but this is partly due to a closer sifting of the causes of death.

“ Old age and heart failure ” appear frequently on death certificates whilst in some cases “ heart failure ” is given as the sole cause of death when the deceased was of a ripe old age.

Tuberculosis is fifth in the list in this table with 6.3%. This is about the percentage of deaths due to this disease in England and Wales.

When it is taken into account that tuberculosis is a cause of death in “ young ” adult life then the disease is set in a truer perspective.

Whooping cough and measles appear as killing diseases in 1938 but malaria although so prevalent, was apparently not an important cause of death. Cases of malaria which were certified chiefly, of course, in the Three Towns were responsible for only 8 deaths in 1938 as compared with 14 in 1937.

Causes of Deaths Under One Year.

The following table is compiled from the certificates given by medical practitioners in 78 cases that died under one year of age.

(1) Pneumonia and Bronchitis	...	...	...	...	34	43.6%
(2) Diarrhoea	...	...	...	...	23	29.5%
(3) Prematurity, Debility Malformations, etc.	...	...	...	...	7	
(4) Syphilis	...	...	...	...	4	
(5) Whooping Cough	...	...	...	...	2	
(6) Other Causes	...	...	...	...	8	
					<hr/> 78	

Here it is seen that in 1938 pneumonia and diarrhoea were responsible for about three quarters of these deaths.

Both are to some extent preventable diseases as indeed is syphilis.

In lands where the infant mortality rate is low, the chief cause of death is the ill-defined group that includes prematurity, malformations, etc.

COMMUNICABLE DISEASES.

Associated with the heavy rainfall and high rivers there was an increase in those diseases known to be carried by mosquitoes and flies.

There were 731 reported cases of malaria locally contracted (*i.e.*, in the Three Towns) as compared with 149 in 1937.

The enteric fevers, dysenteries and diarrhoeas were more prevalent whilst measles and whooping cough—usually mild diseases in the Sudan—were prevalent and sometimes severe.

COMMUNICABLE DISEASES

SHOWING NUMBER OF CASES NOTIFIED AND PLACE.

Disease	Khartoum Local Cases	Khartoum North Local Cases	Omdurman Local Cases	Total of Local Cases	Rural Dist. Cases	Imported Cases	Relapsed Cases	Grand Total
Ankylostoma ...	—	—	—	—	2	—	—	2
Bilharzia ...	—	1	1	2	81	24	—	107
Chicken Pox ...	72	29	43	144	56	17	—	217
Diphtheria ...	17	5	10	32	2	—	—	34
Blackwater Fever ...	1	—	—	1	—	—	—	1
Amoebic Dysentery...	17	7	107	131	1,074	38	298	1,541
Bacillary „ ...	28	11	1	40	72	3	2	117
Enteric Fever ...	27	4	64	95	3	10	—	108
Kala-Azar ...	—	—	—	—	—	7	—	7
Leprosy ...	—	—	8	8	3	18	—	29
Malaria ...	331	181	219	731	21,324	262	1,404	23,721
Measles ...	73	102	45	220	244	9	—	473
Meningitis ...	—	—	1	1	6	1	—	8
German Measles ...	—	2	—	2	—	—	—	2
Mumps ...	52	45	10	107	969	3	—	1,079
Hydrophobia ...	—	—	1	1	—	—	—	1
Relapsing Fever ...	3	—	1	4	—	12	—	16
Smallpox ...	—	—	1	1	1	—	—	2
Syphilis ...	26	17	5	48	889	1	—	938
Pulmonary Tuberculosis ...	24	3	16	43	7	74	—	124
Non-pulmonary Tuberculosis ...	12	2	23	37	3	24	—	64
Whooping Cough ...	17	20	13	50	1,393	—	—	1,443

BILHARZIA.

There were 107 cases diagnosed—of which 24 are classified as imported.

The disease may have a long incubation period and often relapses so that it is hard sometimes to define locally contracted cases.

Special attention was paid to the disposal of “residual” canal water in the pump schemes of the province and, in one case, a length of canal crossed by a main road was fenced off.

CHICKENPOX.

217 cases were notified. The disease was mild but, on account of its long incubation period and its being highly infectious, it is always troublesome among the many school children of the Three Towns.

Diphtheria.

This disease again showed an increase from 21 cases in 1937 to 34 in 1938.

It occurs more often among the foreigners and seems at times to be imported by them.

A careful search was made for carriers of virulent organisms and, when found, they were treated.

Cases by Race :—

British	...	...	...	1	Other Europeans	...	...	2
Greek	...	...	...	4	Egyptians and Syrians	...	...	5
					Natives of the Sudan	...	...	22

Twenty eight cases were under 15 years of age and twenty under 5 years.

There were five deaths—all among natives of the Sudan. This is a high mortality rate and indicates that the disease is not yet recognised in its early stages.

Dysenteries.

Amoebic Dysentery. 1,541 cases were reported as compared with 939 in 1937. Over 1,000 of these, however, came from the Rural District where an accurate diagnosis cannot be made.

The Three Towns notified 131 cases, or 20 more than last year, Omdurman providing 107 of them.

If the cases in the Three Towns are distributed on a population basis, Omdurman shows 88 of 131 cases, or, applying the disease rate per thousand population of Khartoum, Omdurman would have 45 cases of amoebic dysentery. That, in fact, there were 107 cases notified in Omdurman undoubtedly points to the prevalence there of this chronic, disabling disease.

It is curious to note that 82 of the 131 cases notified occurred in the female sex.

Cases by Race.

British	...	...	...	3	Abyssinians	...	...	2
Greeks	...	...	...	5	Yemenese	...	...	1
Egyptians and Syrians	...	...	...	10	Natives of the Sudan	...	...	110

Of the total of 131 cases, 121 occurred under the age of 45 years. There was only one death (an Abyssinian).

Bacillary Dysentery. There were 40 cases notified in the Three Towns - Khartoum providing 28 of them.

Of 50 cases occurring in the Province the following information is available.

Incidence by Sex :—

40 cases occurred in males, 5 in females.

Incidence by Race :—

British	...	...	...	...	30	(28 among British Troops)
Egyptians and Syrians	...	...	...	...	1	
Natives of the Sudan	...	...	...	...	19	

Incidence by Age Periods :—

1-5	5-15	15-25	25-35	35-45	45-55	Undefined
2	3	24	10	2	2	7

Causal Organisms :—

Flexner	...	...	...	29	(17 among British Troops)	
Shiga	...	...	...	2		
Undefined	...	...	...	19	(11 among British Troops).	

There was one death—a native child aged two years.

Enteric Fevers.

108 cases were reported in the province. Of these 95 cases were notified in the Three Towns as compared with 76 in 1937.

Of these cases 27 occurred in Khartoum, 4 in Khartoum North and 64 in Omdurman, where there had been 9, 11 and 49 respectively during the previous year.

The increase is possibly associated with the higher rainfall and prevalence of flies in the early autumn.

Incidence by Sex :—

67 cases occurred in males, 41 in females.

Incidence by Race :—

(a) Egyptians and Syrians	...	...	...	...	...	...	3
(b) Abyssinians	...	...	...	...	...	...	1
(c) Natives of the Sudan	...	...	...	...	...	...	104

Incidence by Age :—

Age Period	1-5	5-15	15-25	25-35	35-45	45-55	55-65
Cases	16	46	33	8	3	1	1

It is seen that 95 (or 88%) of the cases occurred in persons under the age of 25 years.

Type of Organisms :—

The causal organism in 106 of the cases was B. Typhosus and in one B. Paratyphosus "A". One case was diagnosed clinically.

There were 8 deaths giving a mortality rate of about 7% , which is a low average rate.

Owing, at one time, to the increased prevalence of typhoid fever in Khartoum, prophylaxis with T.A.B. was advised by public notice and made available to all who sought it.

Leprosy.

There were 29 cases notified. 18 were imported, 3 were seen in the Rural District and 8 in Omdurman.

Malaria.

The rainfall was heavy in July and August (321.2mms. or 12.6ins.) that is about twice the rainfall of the whole of a normal year and in September a further 60.8mms. fell.

The rivers were also very high and vast areas of flat and low lying land were flooded. Mosquitoes bred in large numbers and the Province suffered the worst outbreak of malaria for many years.

Waves of adult mosquitoes invaded the city which necessitated widespread spraying of houses by the Public Health Service.

In all there were 23,721 cases reported in the Province as compared with 3,654 in 1937, that is about one tenth of the population; this, however, is probably an underestimate.

As to the Three Towns; Khartoum notified 331 primary cases, Khartoum North 181 and Omdurman 219 where there had been 89, 24 and 36 respectively during the previous year.

As this Province in normal years enjoys—relatively speaking—a reasonable freedom from malaria (*i.e.* some 3500 cases or a rate of about 14 per 1000 of population) its people are very susceptible to the disease. Mass treatment of the sick and the killing of mosquitoes in every stage of their life cycle resulted in the rapid control of the epidemic, which no sooner appeared than it began to fade.

Malaria is—and will long be—the most important endemic disease of the Province.

Primary Cases by Races :—

British	...	...	...	294	Armenians	...	...	...	2
Greek	...	...	...	7	Egyptians and Syrians	...	...	...	31
Sudanese	...	...	...	392	Bornu	...	...	...	1
Abyssinians	...	...	...	3	Fellata	...	...	...	1

Types of Parasites :—

Malignant Tertian	...	...	549	Malignant Tertian and Benign Tertian	...	...	...	4
Benign Tertian	...	...	141	Quartan	...	...	...	3
Benign Tertian and Quartan	...	...	1	Not defined	...	...	...	33

Mosquito Control.

In general, throughout 1938 anti-mosquito work was carried out along the same lines as in past years.

The following table shows the number of infections found and the cost of anti mosquito work in the Province for the years 1938 and 1937 :

Year	Number of Infections.					Cost		
	Khartoum District	Omdurman	Khartoum North	Rural Dist.	Total	Cost Labour £E.	Larvi- cides £E.	Total £E.
1938	3105	2108	1427	23,350	29,990	2,966	1,545	4,511
1937	1738	1013	1201	7,009	10,961	2,995	1,393	4,388

The unusually heavy rainfall turned vast areas to the south of Khartoum into lakes. Mosquitoes bred freely and were carried by the south wind into Khartoum.

The Nile flood was very high and inundated long strips of land already growing grasses watered by rain. Indeed what might fairly be called “ ideal ” mosquito breeding conditions held sway.

Roads were for a time impassable and the carriage and distribution of larvicides was a difficult matter. As an experiment pools were sprayed with Paris Green from aircraft and this proved a useful method.

In the Towns, householders were urged to spray their houses and gangs of men were permanently employed in the inspection and spraying of all houses and outbuildings.

There is no doubt that this anti-mosquito work proved of great value in this difficult year.

During the rains the boles and trunks of 111 large trees along the river front were found to be holding rainwater and seven “ *Aedes* ” infections were found. None of these proved to be *Aedes aegypti*. These holes have since been filled with earth.

Several pump schemes were often a source of mosquito breeding, due mostly to faulty canal construction. The chief danger lies in the breeding of mosquitoes throughout the year, giving no period of freedom, and a “ flying ” start when rain and river pools form.

248 cases of malaria occurred amongst the British Troops despite the special measures taken in barracks.

Meningitis.

Eight sporadic cases were reported. Six from the Rural District, one from Omdurman and one imported.

Three of these cases were notified as cerebrospinal meningitis and five as “ acute ”.

Mumps.

Mumps was prevalent throughout the year. 1,079 cases were notified.

There were five cases in the Central Prison.

Rabies

There were five cases of canine rabies confirmed by section. The whole Province except Khartoum and east of the Nile was declared an “ infected area ”.

There was one case of hydrophobia which died on admission before vaccine treatment had been started.

Relapsing Fever.

Sixteen cases were notified, of these twelve were imported cases, the other four being locally contracted but among immigrants. Only one patient was a local native.

The usual measures were undertaken and close watch was kept on all immigrants from the Gezira. There was no difficulty in persuading these immigrants to subject themselves to these measures.

702 persons were deloused.

Smallpox.

Two cases occurred of whom one died.

As smallpox was prevalent in the Gezira at this time comprehensive measures were taken to prevent the movement of unvaccinated persons into Khartoum and an intensive vaccination campaign was carried out.

In all some 58,564 persons were vaccinated, that is about one quarter of the population of the Province.

Syphilis.

938 cases were reported, 48 cases being local. Notification is of course incomplete.

Congenital syphilis is not often seen although four deaths in infants under one year old were attributed to this cause in a series of 78 death certificates given by medical practitioners.

Of 83 admissions to the Central Prison in 1938, 12 had positive blood tests.

Tuberculosis.

188 cases of tuberculosis were notified in 1938 of which 124 were "Pulmonary" and 64 "Non-pulmonary" as compared with 175 and 73 respectively in 1937.

Although this does not seem a large number yet it will be seen that tuberculosis is fifth on the list of killing diseases in an analysis of 695 death certificates given by medical practitioners and accounts for 6.3% of the deaths. Indeed in this list tuberculosis caused as many deaths in 1938 as the typhoid fevers, malaria, diphtheria, diabetes and syphilis put together.

Tuberculosis is the cause of about 6% of the deaths in England and Wales where the disease is considered to be one of the foremost public health problems and where large sums of money are spent in efforts to lower its incidence. It is a disease of young adults occurring in the working years of a man's life. Of the 122 cases of known age notified in 1938, 99 or 81% fell in the age period 15-45 years.

In the seven years 1931-1937 650 cases of pulmonary tuberculosis came under treatment in this Province; the fate of 403 is known: 337 died and 66 are alive (the remainder left the Province or cannot be traced).

The figures show that about one patient in ten is alive seven years after first reporting sick, that these patients are doomed to several years of chronic invalidism and are for those years a source of infection to others.

In 1938 the examination and re-examination of house contacts of pulmonary tuberculosis was initiated. Such examinations serve a two-fold purpose: one to detect early cases of the disease, for the sooner a patient comes under treatment the greater his chances of recovery: and the other to seek out the original source of infection as for example, the old chronic case living in the house.

At the same time closed "sputum pots" were supplied to patients in their houses.

Cases by Sex.

					Pulmonary.	Non-pulmonary.
(1) Males	...	...	...	...	108	33
(2) Females	...	...	...	...	16	31

Cases by Age:

Age Period:	1-5	5-15	15-25	25-35	35-45	45-55	55-65	Over 65	Un-known
Pulmonary ...	—	—	27	45	27	11	6	6	2
Non-Pulmonary	1	11	16	22	8	3	2	—	1

Cases by Occupation.

						Pulmonary.	Non-pulmonary.
Shopkeepers and Artisans	...	...	...			26	4
House servants	...	...	...	...	...	5	1
Labourers	...	...	...	...	...	16	1
Clerks	...	...	...	...	...	10	1
Cultivators	...	...	...	...	...	19	5
Soldiers, Police, Orderlies	...	...	...			4	—
Car drivers	...	...	...	...	...	2	1
Hospital attendants	...	...	...	...	...	6	—
Others	...	...	...	...	...	6	3
Indigent, Unemployed, etc.	...	...	...			14	11
Women	...	...	...	...	...	16	25
Children under 15 years	...	...	...			—	12

The following table shows the result of a follow-up of 650 cases of pulmonary tuberculosis notified from 1931 to 1937 :—

YEAR OF NOTIFICATION	No. of Cases	Died	Condition in December, 1937			Total
			Left District	Alive in District	Untraced	
1931 { LOCAL ... IMPORTED ...	30 39	21 16	4 19	2 —	3 4	69
1932 { LOCAL ... IMPORTED ...	56 40	39 22	10 15	4 —	3 3	96
1933 { LOCAL ... IMPORTED ...	57 44	40 19	8 23	7 1	2 1	101
1934 { LOCAL ... IMPORTED ...	49 34	37 8	6 22	4 2	2 2	83
1935 { LOCAL ... IMPORTED ...	63 41	43 14	5 23	11 1	4 3	104
1936 { LOCAL ... IMPORTED ...	51 44	23 15	7 13	17 1	4 15	95
1937 { LOCAL ... IMPORTED ...	54 48	30 10	6 23	12 4	6 11	102
TOTAL ...	650	337	184	66	63	650

The following table shows the result of a follow-up of 351 cases of non-pulmonary tuberculosis notified from 1932 to 1937 :—

YEAR OF NOTIFICATION	No. of Cases	Died	Condition in December, 1937			Total
			Left District	Alive in District	Untraced	
1932 { LOCAL ... IMPORTED	25 11	8 1	3 7	9 2	5 1	36
1933 { LOCAL ... IMPORTED	56 20	17 1	7 13	23 1	9 5	76
1934 { LOCAL ... IMPORTED	41 17	15 2	6 13	16 —	4 2	58
1935 { LOCAL ... IMPORTED	44 17	11 3	5 12	22 2	6 —	61
1936 { LOCAL ... IMPORTED	36 12	11 1	3 4	17 5	5 2	48
1937 { LOCAL ... IMPORTED	45 27	13 1	5 11	18 2	9 13	72
TOTAL ...	351	84	89	117	61	351

Whooping Cough.

There was an increase in whooping cough—1,443 cases as compared with 284 in 1936.

In the autumn the disease took on an unusually severe form.

Pneumonia.

As pneumonia appears to be one of the chief causes of death in Khartoum, the Assistant Director, Research “typed” the organism responsible in a number of cases. The object of this investigation was to see whether pneumonia as occurring in Khartoum was likely to prove amenable to the expensive serum treatment.

It was found, however, that this form of treatment was unlikely to be of benefit. Fortunately there is reason to suppose that the new drugs of the sulphanilamide group may prove of real value in the treatment of this disease.

KHARTOUM NORTH CENTRAL PRISON.

The average daily strength of the prisoners was 367 excluding patients of unsound mind who are cared for in a special compound.

The general health of prisoners was good.

There were 306 admissions to hospital but of these 56 were admitted as patients from other local prisons.

Of the admissions 87 were for malaria, 50 being inmates of the Central Prison. 5 cases of mumps, 40 of chickenpox and 12 of influenza occurred during the year.

Of the bowel diseases, there were five of amoebic and one of bacillary dysentery.

Six cases of syphilis were treated as inpatients and twelve as outpatients. Of 83 prisoners admitted 12 were found to have positive blood tests.

The patients of unsound mind kept in good bodily health and it was found possible to allow them generally a greater measure of liberty, several of them working at rope-making and other crafts.

There were 15 “ juveniles ” in special quarters.

No case of the deficiency diseases was detected and the prisoners presented generally a picture of physical well-being.

EXAMINATION OF SCHOOL CHILDREN.

During 1938 39 schools were inspected and 6,169 boys examined.

Some few small improvements were made in school buildings but accommodation in many instances is still inadequate.

The results of examination of the school children are much the same as in the last few years. The incidence of trachoma shows an increase (37% to 42%) but some new (and “ untreated ”) schools were examined and different observers may classify “ border-line ” cases differently.

			1935	%	1936	%	1937	%	1938	%
			—		—		—		—	
Number examined	...	...	2,460		2,814		5,601		6,169	
Trachoma	...	...	1,120	(45.5)	1,055	39.5)	2,074	(37)	2,612	(42)
Defective Vision	...	...	245	(10)	233	(8)	245	(4)	892	(14)
Dental Defects	...	...	245	(10)	267	(9)	559	(10)	944	(15)
Albuminuria	...	...	43		163		332		162	
Splenomegaly	...	...	75		53		152		154	
Diseases of Ear, Nose and Throat	...	...	32		64		167		496	
Cardiac Defects	...	...	30		26		22		36	
Pulmonary Diseases (Non-tuberculous)	...	...	3		9		5		15	
Skin Diseases	...	...	—		24		7		55	
Other Conditions	...	...	62		29		55		—	

Facilities were provided for some forms of treatment at hospital and trachoma was treated at the schools by visiting dressers.

Trachoma continues to be the major disability found among schoolchildren. The boys were generally all treated—but we could only carry out very little treatment among the girls of the three schools examined.

The following is a note by the Ophthalmic Surgeon (Dr. A. R. McKelvie) :—

“ I have been looking through the records of trachoma in the Gordon Memorial College and Primary Schools in Khartoum and Omdurman for 1938 and note that there is a considerable improvement.

Most of the cases are Tr. III, Tr. Q, or Tr. IV even among the junior classes showing that these boys have all been infected before reaching their present ages.

I feel that, if we are to achieve success in the proper treatment of trachoma in schools, we ought to concentrate on the elementary and village schools. As treatment in the senior schools has been surprisingly effective in improving the eye conditions, it seems a pity if we are unable to tackle the cases earlier and so lessen the disabilities resulting from pannus and cicatricial changes in the cornea.”

The table gives the results of trachoma work in the schools as shown by examination of the youths at the Gordon Memorial College :—

YEAR.	Percentage Active Trachoma.					
1932	85
1933	61
1934	48
1935	24
1936	22
1937	23
1938	17

We also examined 2,880 village school boys and undertook a little treatment.

Number examined	...	...	...	...	...	2,880	
Trachoma	...	...	...	...	...	2,003	69.5%
Spleen	...	...	...	...	...	179	6.2%
Bilharzia	...	...	...	...	...	24	—
Albuminuria	...	...	...	...	...	196	6.8%

A high percentage of trachoma was found— a condition now shown to be amenable to mass treatment.

Sir Frederick Menzies (Medical Officer of Health to the London County Council) visited one small school and thought the general state of nutrition of the boys was good.

In Khartoum ninety school boys of known age (12 years) gave the following mean measurements as compared with a sample of boys of the same age in England and Wales :—

(1) Height	Khartoum	...	...	...	...	4 ft. 9"
	England and Wales	...	...	...	...	4 ft. 8½"
(2) Weight	Khartoum	...	...	...	...	5 st. 2 lbs.
	England and Wales	...	...	...	...	5 st. 6 lbs.

METEOROLOGICAL OBSERVATIONS **AT** **STACK MEDICAL RESEARCH LABORATORIES, KHARTOUM.** **1938.**

Month.	Temperature in Degrees Fahrenheit			Mean Relative Humidity % at 8 a.m.	Average Evaporation in m. m.	Rain in m. m.	Dust and sand storms	Prevailing Winds
	Mean Temp.	Mean Max. Temp.	Mean Min. Temp.					
January	73.2	91.6	59.0	40	8.2	—	5	N.
February	77.6	95.4	64.2	32	10.4	tr	7	N.
March	76.8	96.0	62.4	22	11.4	—	5	N.
April	91.2	110.4	76.0	22	14.8	tr	4	N.
May	91.4	110.2	76.8	21	14.2	tr	7	N.
June	90.5	106.8	75.6	24	13.0	—	3	NW.
July	84.4	95.6	76.0	68	8.2	158.8	2	S.
August	81.6	91.0	74.4	76	5.1	162.4	4	S.
September	85.1	97.6	75.8	67	7.2	60.8	5	S.
October	88.2	104.6	74.8	40	10.0	tr	4	N.
November	81.6	99.5	68.6	40	9.2	—	2	N.
December	76.5	95.0	62.0	38	8.5	—	3	N.

NORTHERN PROVINCE.

Area 236,200 square miles. Population 549,525.

The general health of the province was satisfactory during the year. Climatic conditions were favourable and the rainfall in the southern area was above the average.

Harvests on the whole were plentiful and the economic condition of the people satisfactory. In the Merowe District the high river was responsible for some loss of property and crops—a hardship not without benefit as several insanitary and overcrowded areas were thereby rendered uninhabitable and the people persuaded to rebuild better houses at a higher level.

No major epidemic occurred during the year. There were mild outbreaks of chickenpox, mumps, influenza and whooping cough and sporadic cases of cerebrospinal meningitis.

Malaria, bilharziasis, syphilis, eye diseases and tuberculosis are among the more important endemic diseases.

In the rural areas of the northern district malaria is responsible for 25%—30% of all cases seen. This year largely as a result of improved control measures and in spite of the abnormally high river, there was no appreciable increase in the number of cases.

In the southern area owing to unfavourable climatic conditions incidence was increased and two major outbreaks occurred.

Bilharziasis, a mild disease in this province, tends to decrease year by year, though endemic foci still exist in irrigated areas.

Tuberculosis shows some increase. Many cases are infected in Egypt. It is hoped that by better housing and improved nutrition resistance to the disease will be assisted.

There were fewer cases of enteric fever and some improvement in the incidence of amoebic dysentery.

This province is well served by hospitals and dispensaries and efforts are now concentrated on improving the living conditions of the people.

Much has been achieved during the past year. Sanitary services and water supplies have been augmented and improved, anti-malarial measures extended. Slum clearance has been carried out in the larger towns and considerable improvement has been noted in cleanliness of villages and the type of house erected.

BLUE NILE PROVINCE.

Area 43,800 square miles. Population 1,351,919.

The health of the province was adversely affected by the prevalence of smallpox and relapsing fever in two districts and by a general rise in the incidence of malaria.

Locusts took a heavy toll of the harvest. Fresh sowing, later rains and irrigation helped to relieve the position to a large extent and there did not appear to be any deterioration in the condition of the people.

A smallpox epidemic, severe but happily short-lived, broke out in the Gezira irrigated area during the year: The infection was of a virulent type and the presence in the area of a large number of unvaccinated immigrants at the height of the cotton picking season gave rise to an anxious situation. A prompt and energetic campaign, in the course of which some 200,000 persons were vaccinated, was successful in confining the epidemic to a limited area with the minimum dislocation of labour conditions. A further 84,000 and 93,759 vaccinations were carried out in the adjacent Fung and White Nile districts respectively.

Relapsing fever was endemic throughout the province, the cases were sporadic and scattered and at no time reached epidemic proportions.

Unusually heavy rains, coupled with an exceptionally high flood, produced a sharp rise in the incidence of malaria in most areas.

The vector is *A. gambiae* and the predominant infection malignant tertian. The control of mosquito breeding was continued on the lines outlined in previous reports.

In the Gezira area Paris green was used during the rains for all collections of water outside canals. The advantages of Paris green are that it is cheaper than oil and large areas can be treated more quickly. Its disadvantages are that it does not kill one to two day old larvae, it is not a deterrent to the female laying eggs, it only kills anophelines, and it must be reapplied at least every seven days. It is thought that there may be another stage where it is not effective *i.e.* when the larva is passing into the pupal stage. Further investigations are being made to confirm this supposition. Considerable success attended experiments carried out in the use of Paris green on the foreshore of the White Nile and it is proposed to employ this larvicide on an extensive scale in the future. No evidence of poisoning came to light. In the irrigated area, baling is found to be the best method of mosquito control. It is an absolute measure, efficient and inexpensive. In some new extensions, where the channels were not silted, oiling was done. The methods adopted were the placing in canals of metal rods on which sacking soaked in oil was suspended or the pouring of oil direct into water channels. Both methods proved successful under close supervision.

The situation in regard to bilharziasis in the irrigated area remains unchanged. Large numbers of immigrant labourers temporarily resident in the area are infected and it is only by continuous effort and close supervision that it is possible to prevent the disease making progress. It is again emphasised that the solution of the problem is a good water supply. Some advance in this direction was made during the year. 8 new wells were dug out and 14 old wells were repaired. In two villages water was supplied from a nearby canal by a pipe line to a rotary pump. The usual methods of prevention have been continued *i.e.* siting of villages 300 metres from canals, prevention of bathing, provision of latrines, and inspection and treatment of canals to kill snails.

KASSALA PROVINCE.

Area 134,450 square miles. Population 390,722.

The general health of the province was good. Relapsing fever and smallpox, which had been prevalent during the previous year continued to occur sporadically throughout the province. There was some increase in the incidence of relapsing fever, as in addition to infection produced from Abyssinia, cases

occurred amongst people returning to the province from the Gezira area. The vaccination campaign carried out in 1937 was almost complete by the end of the year and smallpox soon became sporadic and died out. 25,240 persons were deloused and 58,240 persons vaccinated during the year.

There were fewer Sudanese labourers returning from Abyssinia and Eritrea than last year but ulcers, septic wounds, and cases of malnutrition were very prevalent among them. Such people are an easy prey to diseases such as relapsing fever and the dysenteries. In their debilitated condition slight wounds turn to bad ulcers and osteomyelitis is very common.

There was a somewhat higher incidence of malaria than in 1937 owing to heavier rains and the greater volume of the River Gash.

Attempts were made to bring under control the thickly wooded and overgrown area along the banks of the river. Rides were cut through the undergrowth and flooded areas treated with Paris green.

The incidence of other endemic disease shows little change from that of previous years.

Conservancy and refuse disposal systems have been augmented and improved in both Kassala and Gedaref. In Kassala pit latrines are a potential source of danger as the water supply is largely from wells and the subsoil water in many cases is only a few feet from the surface. Plans are in hand to replace all pits by buckets. Efforts are being made to obtain the cooperation of native authorities in the promotion of hygiene in villages and instructions for their guidance have been prepared by the public health staff.

Port Sudan—Population 22,147.

The health of the Port and district has been satisfactory. There was no serious outbreak of infectious disease. 136 cases of chickenpox and 63 of mumps were isolated in the quarantine hospital. Bronchitis and pneumonia were prevalent during the winter months and dysentery in the late summer. Climatic conditions in August and September were extremely trying, the thermometer registering 103 degrees at night on several occasions. Three deaths from heat exhaustion occurred.

Many of the diseases common to other parts of the country do not occur as primary infections in Port Sudan. Schistosomiasis, leishmaniasis, ancylostomiasis and malaria are rare except amongst imported labourers. Syphilis, gonorrhoea, eye conditions and the bowel diseases provide the bulk of cases attending hospitals and dispensaries. The incidence of both pulmonary and non-pulmonary tuberculosis, although less than last year, is comparatively high and is associated with the warm humid conditions of the coastal belt.

There were 630 admissions for amoebic dysentery and diarrhoea and enteritis accounted for a further 250 cases. Fly infestation has always been bad in Port Sudan especially during and after the rains. The continuous humid, warm atmosphere is very favourable to breeding and constant vigilance has to be exercised by the public health staff. Weekly house to house inspections to ensure cleanliness of compounds and adequate disposal of dry rubbish and waste water has led to some improvement, but the latrine accommodation in the native lodging areas is inadequate and promiscuous defaecation rife. Plans are under consideration for remedying this defect.

Waste water disposal is a difficult problem. The surface soil is a salty coral and somewhat impervious to water, gardens are few and plots in many instances not large enough to allow of surface irrigation, consequently it has been decided that soakage pits with a septic tank type of grease trap shall be installed in all houses.

Port Sudan, built on coral, is served partly by a water carriage system with septic tank or cesspool connections and partly by a bucket system. Experience has shown that septic tanks installed some 12 years ago are still working satisfactorily and have not required any attention. Lately this system has been widely extended. It is now insisted that septic tanks with effluent pits are installed in every new building and during the past year as many water flush latrines have been installed as were present in the whole of Port Sudan up to the end of 1936. The new public water flush latrine erected this year in the market area has proved very satisfactory.

2273 buckets are in use, sewage is discharged partly into the sea, partly into shallow trenches.

Anti-mosquito work. *Aedes* infections are common and occur mostly in the native lodging areas. Since the institution of house to house inspections the numbers have dropped considerably. *Culex* and anopheline infections are found in wells and in the seepage water of quarries.

Rat Control. There are few places where fumigation for rat destruction can be carried out and poisons appear to lose their efficacy after a time, consequently the method of trapping appears to be the only satisfactory method.

Recently the number of traps and rat catchers have been increased considerably with the result that the monthly catch during the latter half of 1938 was double that of the previous year.

Warehouses are made rat-proof. All galvanised iron warehouses have had the lower course of galvanised iron replaced by concrete. All ships moored to the quays are required to have rat guards.

The total number of rats caught during the past five years is as follows :—

1934	1935	1936	1937	1938
6,705	6,134	5,302	8,499	12,215

Of the 12,215 rats caught this year 2,667 were *Rattus rattus rattus*.

4,645 „ *Rattus rattus alexandrinus*.

4,903 „ *Rattus rattus frugivorous*.

Rat Fleas—The flea census per month together with the prevailing atmospheric conditions were as follows :—

MONTH.	Fleas per rat.	Average Temperature Shade.		Average Relative Humidity.
		Maximum °C.	Minimum °C.	
January	0.7	31.1	15.9	58
February	0.7	29.8	13.9	58
March	0.6	30.7	14.5	59
April	0.9	35.5	16.7	53
May	0.8	41.8	18.6	48
June	0.8	39.2	21.8	43
July	0.8	45.7	24.0	45
August	0.6	46.2	26.5	49
September	0.6	43.2	25.6	59
October	0.6	38.2	22.5	71
November	0.8	33.7	20.5	77
December	0.8	30.8	18.2	78

Water Supply. During the year a survey of the piped supply from Khor Arbaat was carried out. The pipe line was thoroughly tested—all pressure tanks and the storage reservoir cleaned and treated with chlorescene. The following is the last report from the Laboratories “The excellent quality of water from Khor Arbaat is maintained throughout the system.”

KORDOFAN PROVINCE.

Area 147,600 square miles. Population 1,241,295.

The province remained free from major epidemics but the autumnal incidence of malaria was high and small local outbreaks of cerebrospinal meningitis, smallpox and relapsing fever occurred.

260,391 persons were vaccinated, and 34,067 deloused during the year. Malaria, bilharziasis, syphilis, ulcers, eye diseases and chronic amoebic dysentery provided the majority of cases attending hospitals and dispensaries. Dracontiasis is prevalent throughout the Nuba Mountains and causes much invalidism. It is associated with the absence of proper wells in most villages. The problem of the eradication of this disease is extremely difficult owing to the fact that even if proper wells were installed the natives during the rains will drink from infected rock pools which are numerous and handy. A further decline in the incidence of syphilis was noted but it is still prevalent in the Nuba Mountains where it accounts for 27% of the admissions to hospital.

Malaria which causes much debility remains the chief medical problem of the province. There are innumerable breeding places of anophelines in the rural areas which cannot be controlled and during and after the rains large numbers of adult mosquitoes gain access to the towns.

Anti-larval measures have been extended and improved where practicable but personal prophylaxis including the wiring of houses, the use of nets and the destruction of adult mosquitoes with insecticides remain the most hopeful measure of lowering the malarial rate.

Progressive improvement has taken place in the sanitation of El Obeid and some of the larger towns. The tipping and burying of refuse in old wells and depressions in several areas served the dual purpose of disposing of the refuse and of eliminating potential mosquito breeding grounds.

More attention has been paid to the education of the public in health matters ; lectures have been given in schools and clubs and propaganda spread in the rural districts.

DARFUR PROVINCE.

Area 138,150 square miles. Population 763,386.

The general health of the province, save where affected by epidemic disease and an increase in the incidence of malaria, compared favourably with that of previous years.

There was a plague of locusts in certain areas resulting in a serious loss of crops. This loss may be reflected in the health of the people during 1939, but last year's supplies were adequate and so far there has been no evidence of undernourishment.

Minor epidemics of relapsing fever (212 cases) and smallpox (78 cases) occurred scattered throughout the province, the former mainly in areas bordering on the northern route from French Equatorial Africa. Both diseases were introduced from outside. Relapsing fever coming from the east and smallpox from the west. Vaccinations were carried out on a large scale and a scheme to vaccinate the whole of the province was planned at the end of the year. The spread of relapsing fever was checked by the establishment of delousing stations and quarantines on the main route to the east in Kordofan and at the more important centres in northern Darfur.

These measures appeared to be effective as no further cases occurred in this area and frequent check inspections of the people showed that they had been at least once through a delousing station.

There was an increase in the incidence of malaria, especially in Fasher and a greater percentage of British and native officials contracted the disease.

The problem regarding other endemic disease remains much the same as in previous years. It is hoped that in future propaganda and treatment may reduce the number of cases of bilharzia and syphilis.

Steady progress has been made in the sanitary services of El Fasher and the larger towns, the system of house-to-house inspection has been extended and as a result a marked improvement in the cleanliness of compounds has been noted. A beginning has been made in the improvement of village sanitation. In the western district propaganda and practical demonstration in schools and villages has had most encouraging results.

UPPER NILE PROVINCE.

Area 100,400 square miles. Population 509,491.

Climatic conditions in the earlier part of the year were normal but the rains throughout the province were very heavy and the river remained abnormally high. Locusts partially destroyed the grain crops in some parts of the province which will probably result in a shortage of grain in 1939.

Influenza was prevalent in the Shilluk country and measles and mumps broke out in Malakal. Otherwise the province was remarkably free from epidemic disease.

A sharp outbreak of typhoid fever occurred in Malakal. 46 cases were notified as compared with an average of 10 cases in previous years.

Typhoid fever has been endemic in Malakal for the past 12 years and there must be a large number of carriers resident in the town. The cases were scattered and the outbreak could not be traced to any particular source. There were 10 deaths.

Malaria, trichiasis, tropical ulcer and syphilis provide the bulk of the cases treated in hospitals and dispensaries. Leishmaniasis is endemic over a larger area than at first supposed.

Public health work in this province is limited to the control of sanitation and mosquito breeding in towns.

Progress has been made in the cleaning up of Malakal and plans are under consideration for the extension of the conservancy system. Following the outbreak of typhoid fever, steps were taken to chloroform all drinking water supplied to officials, but it was not found practicable to treat the general supply.

drawn from the river. Towards the end of the year work was commenced on the installation of a purified piped supply. Stand pipes are to be provided at various points in the town and the native lodging area.

Anti-mosquito control was rendered difficult owing to heavy rains and the high river. Special attention was paid to the elimination of possible breeding places of *Aedes aegypti*.

EQUATORIA PROVINCE.

Area 159,750 square miles. Population 1,251,432.

The number of natives seeking medical aid continues to increase. Facilities for treatment have been improved and extended in so far as funds have allowed. Progress in routine medical work has been unimpeded by the presence of any serious epidemic. A localised outbreak of cerebrospinal meningitis occurred in the Aweil area and mild smallpox simmered in the Dinka district. Measles became endemic in a number of areas at the end of the year and sequelae caused many deaths amongst children. Small outbreaks of influenza with high mortality were reported from Yei and Yubu and 79 cases of pneumonia with 9 deaths occurred in the Juba area.

The outbreak of sleeping sickness at Kajo-Kaji was checked. In part of the Tembura sub-district the disease remains endemic. A circumscribed outbreak occurred 5 miles west of Yubu and near the Belgian Congo border. Prophylactic Bayer 205 injections for the whole section of population infected are now being given. This outbreak serves to emphasise the everpresent danger of re-infection and the necessity for complete inspections. Prevention by fly control, carried out by junior public health staff, has had a year's trial and the results already obtained are sufficiently encouraging to warrant the method being continued and extended. 48,261 flies were caught in the Kajo-Kaji district, and 33,956 in the Yubu river system.

Malaria continues the major invaliding disease of all officials. The exceptionally heavy rainfall contributed to the increased incidence this year.

The anti-guinea worm well programme is producing good results especially in the Juba district where 144 wells have been constructed.

Hookworm is on the increase and is likely to become a major scourge. A free issue of canvas shoes has been suggested as a preventive measure which might prove cheaper than treatment.

Syphilis and Yaws are widespread especially in the Wau and Zande districts. Some 2.5% of the population of Tembura district sought treatment for syphilis.

A decrease in amoebic dysentery has been noted throughout the province.

Steady progress has been maintained in the consolidation and extension of public health work in the province. All principal stations have been visited by the British sanitary inspector and the local services inspected. Conservancy requirements, water supplies, and mosquito control measures have been reviewed in all areas and a programme of improvement prepared.

Sanitary services in Juba have been augmented and mosquito control tightened up. Unusually heavy rains added greatly to the difficulties of the work, and the high proportion of anopheles was an outstanding feature.

A pure and wholesome milk supply became available in Juba for the first time. The Government dairy, entirely supervised by the Medical Service now produces and markets milk under hygienic conditions. The milk is in great demand and the dairy is likely to prove a popular institution.

MATERNITY AND CHILD WELFARE.

MIDWIVES.

15 pupil midwives completed the course of training at the School of Midwives, Omdurman. All passed the qualifying examination, having conducted more than 20 confinements and assisted in another 20 cases. Their development and improvement during the period of training was encouraging and with adequate inspection they should prove useful midwives.

The school continues to do excellent work. 319 midwives have been trained since the school opened 18 years ago, and of these 253 are still practising.

Their distribution is as follows :—

Khartoum Province	...	...	65	Northern...	...	...	...	73
Blue Nile	„	...	35	Kassala	...	...	...	24
White Nile	„	...	10	Kordofan	...	...	...	34
Upper Nile	„	...	3	Darfur	...	...	...	9

17 of these are also trained nurses. The work of the town and rural trained midwives is satisfactory, considering the difficulties they have to contend with especially in the small district villages where medical assistance is often unobtainable. The people appear to appreciate their services, and often express a desire to increase their number. Candidates for training are usually forthcoming without much persuasion. In many places the midwives assist in out-patient work in the local dispensary and in some districts they have assumed the role of health visitor.

Midwives are valuable media of medical and public health propaganda and in due course should induce many patients to receive treatment who would otherwise not do so.

The usual tours of inspection in the provinces were carried out by the staff of the training school. Work and equipment of practising midwives were checked and candidates for training selected.

MATERNAL MORTALITY.

The following statistics, relating to maternal mortality and the complications of child birth, are compiled from cases admitted to the Khartoum and Omdurman hospitals. These figures cannot be taken as typical of the whole of the northern Sudan, but they give some indication of the risks associated with pregnancy and parturition, conducted under the best available conditions.

Total number of live births registered in Khartoum, Khartoum North and Omdurman — 3506.

Total cases attended in hospital — 229.

(a) Normal	...	67	(c) Recovered	...	218
(b) Abnormal	...	162	(d) Died	...	11

Complications and Causes of Death.

					Total.	Recovered.	Died.
Abortions	... Septic	...	...	7			
	Others	...	...	85	92	90	2
Puerperal sepsis	... (Normal labour	...	...	13			
	(Abnormal labour	...	...	7	20	15	5
Puerperal haemorrhage	(Placenta praevia...	...	...	10			
	(Other causes	...	...	7	17	17	—
Puerperal albuminuria and convulsions	...	...	...		8	6	2
Other toxæmias of pregnancy	...	...	...		5	3	2
Phlegmasia alba dolens	...	...	...		—	—	—
Embolism	...	...	...	...	3	1	2
Other accidents and abnormal conditions of the puerperal state	...	...	...		52	49	3
Illness complicating, but not directly due to pregnancy	...	...	...	...	39	37	2
					<hr/>	<hr/>	<hr/>
					* 236	218	* 18

*In seven of these cases more than one complication was present and was a contributory cause of death.

In Omdurman the town midwives attended 1968 cases, 23 being classified as abnormal. 24 cases were transferred to hospital where one died. Another died on the “ district.” 70 cases of abortion were treated by the midwives ; three of these were septic and sent to hospital where one died.

The total cases delivered in Omdurman, on the “ district ” and in hospital, give the following rates per 1000 live births :—

Total maternal mortality	...	...	...	...	...	5.14
Puerperal sepsis mortality	...	...	...	...	...	2.06
Infant mortality rate	...	...	...	...	...	92.

It must be realized that these rates are calculated from very small figures (*e.g.* 10 maternal deaths) and one added maternal death may change the rate considerably.

Nevertheless a comparison of these rates—within such limitations—with those of England and Wales for 1934 present a satisfactory picture.

(a) Total maternal mortality rate	England and Wales	...	5.85
	Omdurman	...	5.14
(b) Puerperal sepsis rate	England and Wales	...	2.03
	Omdurman	...	2.06
(c) Infant mortality rate	England and Wales...	...	59.
	Omdurman	...	92.

MATERNAL AND CHILD WELFARE CLINICS.

Antenatal clinics have been opened in most towns in the northern Sudan to supplement the work already carried out in the local hospitals. In the larger clinics a British nursing sister is in attendance.

At the Khartoum and Omdurman clinics there were 9,079 attendances of which 4,143 were new cases. In Omdurman 71% of the cases delivered by midwives had attended antenatal clinics.

At the Wad Medani clinic an average of 22 pregnant women are seen weekly. Large numbers of children attend with their mothers and good work has been done particularly in the treatment of eye and ear cases.

In the Northern Province the clinics at Atbara, Shendi and Berber have been well attended. At Atbara there were 958 attendances of which 351 were new cases. The 30 midwives stationed in this area carried out 1,517 deliveries during the year. Two new clinics were opened at Merowe and it is hoped to open a third at Dongola next year.

136 cases attended the clinic recently opened at Kassala and at a new clinic at El Obeid in one month there were 284 attendances of which 125 were new cases.

A modest start has been made at Juba in Equatoria Province and a weekly clinic at a nearby village has been started.

SCHOOL MEDICAL SERVICE.

This Service has been further extended during the year.

40,340 pupils were examined in 569 schools compared with 26,444 in 332 schools in 1937. It is estimated that 90% of the pupils attending Government or Government subsidised schools were inspected and treated during the year in the northern Sudan and there has been a large increase in the number of schools inspected in the south.

In the northern Sudan trachoma is responsible for the majority of cases referred for treatment, the incidence in some schools being as high as 50%. Where treatment has been regular and long continued however there has been marked improvement. The incidence in the Gordon Memorial College has decreased progressively from 85% in 1932 to 17% in 1938. The Government Ophthalmologist stresses the importance of early treatment in elementary and village schools so that the disability resulting from pannus and cicatricial changes may be lessened.

The incidence of bilharzia is high in Darfur, Kordofan and the Halfa area of the Northern Province, but the disease is mild and rarely gives rise to serious symptoms.

This year owing to the generally increased prevalence of malaria the spleen rate is higher in most areas.

With these exceptions the standard of health of school children is satisfactory and there is little evidence of malnutrition. In some instances a general improvement in physique has been noted.

This year more attention has been paid to the education of school children in health matters and lectures in first aid and hygiene have been given regularly in most provinces by junior medical staff.

The following table shows the results of the examinations :—

PROVINCE AND DISTRICT	No. Examined	% Trachoma	% Bilharzia	% Spleen	% Pulm T.B.	% Ankylost.
Blue Nile Province :—						
GEZIRA AREA.						
2 Intermediate ...	210	6.2	0.4	11.9	—	—
1 Girls Schools ...	187	17.1	—	9.6	—	—
8 Elementary ...	2,585	17.2	—	18.5	—	—
130 Village ...	6,889	22.0	0.25	29.6	—	—
FUNG AREA.						
4 Elementary ...	564	12.4	0.7	50.3	—	—
3 Girls Schools ...	209	12.4	—	40.6	—	—
15 Village ...	672	23.5	3.4	53.2	—	—
WHITE NILE AREA.						
1 Teachers Train- ing College	83	13.2	13.2	15.6	—	—
1 Intermediate ...	47	29.7	14.8	31.9	—	—
9 Elementary ...	970	32.3	4.4	50.4	—	—
3 Girls Schools ...	248	24.5	5.6	22.1	—	—
8 Village ...	356	32.3	9.8	53.6	—	—
Darfur Province :—						
3 Elementary ...	312	5.6	34.2	53.5	—	—
8 Village ...	302	46.0	32.1	46.6	—	—

Medical Examinations of Schools.—(Contd.)

PROVINCE AND DISTRICT	No. Examined	% Trachoma	% Bilharzia	% Spleen	% Pulm T.B.	% Ankylost
Equatoria Province :—						
JUBA DISTRICT.						
2 Intermediate ...	192	1.5	—	20.8	—	—
10 Elementary ...	1,301	16.0	2.07	22.9	—	0.07
WAU DISTRICT.*						
ZANDE DISTRICT.						
2 Mission School ...	152	—	36.8	25.0	—	49.3
Kassala Province :—						
KASSALA AREA.						
4 Elementary ...	402	24.5	—	27.7	—	—
2 Girls Schools ...	126	31.7	—	21.8	—	—
15 Village ...	1,094	13.4	—	20.9	—	—
PORT SUDAN AREA.						
1 Intermediate ...	125	28.8	0.8	2.4	—	—
2 Elementary ...	210	34.7	3.3	8.5	—	—
1 Village ...	180	33.8	—	12.7	—	—
Khartoum Province :—						
Gordon College	356	17.1	—	4.5	—	—
Coptic College...	481	19.3	—	1.6	—	—
Comboni College	259	37.0	—	0.7	—	—
Technical School	147	55.8	—	0.7	—	—
11 Intermediate ...	1,770	37.6	—	1.7	—	—
24 Elementary ...	3,156	51.1	—	3.0	—	—
60 Village ...	2,880	69.5	0.8	6.2	—	—
Kordofan Province :—						
1 Intermediate ...	122	19.6	6.5	13.1	—	—
20 Elementary ...	2,224	18.0	16.0	42.6	—	—
9 Village ...	511	11.3	11.1	57.9	—	—
Northern Province :—						
ATBARA AREA.						
2 Intermediate ...	147	37.4	2.0	7.4	—	—
1 Technical ...	42	26.1	9.5	7.1	—	—
14 Elementary ...	1,892	49.0	6.7	7.7	—	0.2
56 Village ...	2,213	41.3	5.9	18.3	—	0.09
HALFA AREA.						
1 Intermediate ...	74	18.9	31.0	—	—	24.3
7 Elementary ...	920	4.4	19.1	2.3	—	1.08
58 Village ...	2,244	5.3	18.0	4.6	—	1.1
MEROWE DONGOLA AREA.						
6 Elementary ...	609	38.7	0.9	21.3	—	2.1
54 Village ...	2,553	25.2	1.6	14.2	—	0.6
Upper Nile Province :—						
1 Elementary ...	123	12.2	2.0	15.0	—	0.4
4 Mission Schools	193	6.7	0.5	42.0	—	1.0
1 Village ...	8	12.5	—	50.0	—	—

*Schools were closed owing to Cerebrospinal Meningitis.

QUARANTINE.

PORT SUDAN QUARANTINE.

Quarantine restrictions were enforced against Siam for the whole year on account of cholera and against Bombay from January to June on account of smallpox.

	1933	1934	1935	1936	1937	1938
Ships arriving	778	886	1181	1148	1,174	1,153
Sailing Vessels	423	509	435	427	599	539
Warships British	14	15	60	24	20	15
„ French	6	6	3	5	—	1
„ Italian	—	1	3	—	3	3

No ships were quarantined during the year and there were no cases of infectious disease from ships.

The system of radio pratique was made applicable to certain steamship lines during the year. The system has worked smoothly and facilitated considerably the quarantine formalities of the port.

The health of the Port and Town was good during the year. With the exception of a few sporadic cases of diphtheria, typhoid, cerebrospinal meningitis and chickenpox, there was no infectious disease.

SUAKIN QUARANTINE.

All Sudanese and West African pilgrims in transit through the Sudan leave via Suakin and return to this port.

Under the term “West Africans” are included those pilgrims coming from west of the Anglo-Egyptian Sudan. A certain proportion of these people classified for convenience as “West Africans” are now, however, permanent inhabitants of the Sudan.

The pilgrim route from West Africa passes from Lake Chad through Fort Lamy, Abesher and Adre to Geneina in the Sudan and thence from El Fasher to railhead at El Obeid.

West African pilgrims tend to leave earlier and to return later than those from the Sudan itself.

This year, there were 8,159 outgoing pilgrims, the largest number ever reached. Of these 1,851 were Sudanese and 6,308 West Africans.

The relative numbers of Sudanese and West African pilgrims for the last six years are as follows :—

	1933	1934	1935	1936	1937	1938
Sudanese	449	558	931	1,315	1,728	1,851
West Africans	521	974	741	2,089	4,618	6,308
	970	1,532	1,672	3,404	6,346	8,159

It will be noted that the number of Sudanese pilgrims has remained fairly constant and that the increase is mostly amongst West Africans.

All pilgrims were vaccinated against smallpox and inoculated against cholera before departure. In addition this year, owing to the prevalence of relapsing fever among West Africans, delousing was carried out where necessary to protect the Hedjaz from infection with this disease.

The smallpox vaccine used was a glycerinated calf lymph prepared in the Stack Medical Research Laboratories in Khartoum. The cholera vaccine was also prepared in Khartoum and used in doses of 4,000 millions (adult male).

6,427 pilgrims passed through Suakin on their return from the Hedjaz. The health of the returning pilgrims was good. The only disease of note was chickenpox of which there were some 47 cases. Apart from chickenpox 20 cases were admitted to hospital, the majority being for malaria and bronchitis.

It was found possible to reduce the period of quarantine from five to three days at the beginning of the pilgrimage season, and this was reduced later to one day only.

This year certain modifications were made in the procedure for dealing with returning pilgrims. Facilities for admission were improved and certain unnecessary routine measures discontinued. Further alterations were also made in the general improvement of amenities.

WADI HALFA QUARANTINE.

1,350 Egyptian labourers passed through the quarantine. Two were repatriated as unfit, 81 were treated for bilharziasis either at Wadi Halfa or at their destination.

OPHTHALMIC REPORT

By MR. A. R. McKELVIE.

58 male beds and 30 female beds are provided for this Department in the River Hospital, Khartoum.

The following figures summarise the work carried out during the year.

		River Hospital.	Omdurman Hospital.	Total.
Inpatients	... ..	615	125	740
Outpatients				
Total Attendances	...	36,781	39,295	76,076
New Cases	... ..	6,019	6,336	12,355
Operations				
Major	... ..	476	84	560
Minor	... ..	316	9	325

TRACHOMA.

Recently, selected cases of trachoma have been treated with Sulphanilamide per os.

The difficulty in this form of treatment is that the patients must be under constant observation and thus only those whom it was possible to keep in hospital or who were sure of attending daily were treated with this drug.

Results were distinctly encouraging especially in the Tr. iii cases and those cases with marked pannus and corneal complications.

Local treatment with 1% drops of silver nitrate and atropine 1% were also used in the keratitic cases.

Spring Catarrh.

An increasing number of these cases have been coming to the River Hospital in the last year or two.

Invariably trachoma has been a complication.

Treatment is unsatisfactory and the relief obtained only temporary.

Both the bulbar and palpebral type are seen.

Inclusion Blenorrhoea.

One case, originally thought to be trachoma, was seen in an European lady who contracted this complaint in Scotland three months before. Inclusion bodies had been found in the conjunctival smears.

The response to sulphanilamide was prompt but only a course of ten days treatment was given as the patients' skin became photosensitive.

IN-PATIENTS TREATED IN THE RIVER HOSPITAL EYE DEPARTMENT DURING 1938.

MONTHS.	EYE LID				Conjunctivitis			Lachrymal apparatus		Cornea				Iris & Ciliary		Cho-roid	Retina		Optic nerve	Lens & Vitreous				Eye Ball			Orbits		Muscles of the eye		Total Discharged per month	Total admissions per month							
	Injury to the lid	Blepharitis	Chalazion	Trichiasis	Tumour of the Lid	Conjunctivitis	Trachoma	Pterygium	Dacryocystitis	Keratitis	Ulcerations	Perforations	Foreign Bodies	Corneal Wounds	Leucoma	Iridocyclitis & Iritis	Prolapse	Choriditis	Retinitis	Detachment	Papilloedema	Cataract Congenital	Senile Cataract	Traumatic Cataract	Dislocation	Injury and Panophthalmitis	Chronic Glaucoma	Sub-acute Glaucoma	Injury	Innocent			Malignant	Strabismus	Defective Vision	Staphyloma			
January ...	—	—	—	—	—	13	2	—	—	—	—	—	—	—	1	1	—	—	1	—	1	1	—	—	1	—	—	1	—	—	—	—	—	—	—	—	23	48	
February ...	—	—	—	2	1	11	7	1	—	1	1	3	—	—	2	2	—	—	—	—	—	—	3	—	3	—	—	6	—	—	1	—	—	1	—	2	1	48	55
March ...	1	—	—	2	—	14	9	—	—	—	2	2	—	—	5	1	—	2	1	—	1	2	4	3	—	—	—	2	—	—	3	1	—	—	—	1	56	64	
April ...	—	1	—	2	—	22	7	—	—	1	—	2	3	7	1	2	—	—	—	—	—	1	10	1	1	—	1	6	1	—	1	—	—	—	5	1	75	66	
May ...	—	—	—	4	—	13	4	—	—	1	2	—	1	—	—	1	—	—	—	—	—	2	12	—	—	—	1	10	—	—	—	1	—	—	2	—	54	60	
June ...	—	4	—	3	—	15	14	1	—	1	4	1	—	—	6	1	—	—	—	—	—	1	11	2	—	—	1	6	1	—	—	—	—	—	3	—	75	62	
July ...	1	3	2	3	—	17	6	—	—	1	—	—	1	1	1	—	—	—	—	—	—	1	15	2	—	—	1	7	1	—	—	—	—	—	1	3	67	47	
August ...	—	—	—	6	—	8	3	—	—	1	1	—	1	1	1	—	—	1	1	—	—	2	9	—	—	—	1	2	—	—	3	—	—	—	—	2	42	36	
September ...	—	2	—	2	—	9	4	1	—	1	1	—	—	—	4	1	—	—	—	—	—	1	5	2	—	—	1	1	—	1	—	—	—	—	—	1	37	36	
October ...	—	—	—	6	—	24	7	—	—	2	1	—	—	—	3	1	1	—	—	—	—	1	9	2	—	—	—	3	—	—	—	—	—	—	—	—	60	41	
November ...	—	—	—	4	—	8	8	—	—	3	1	—	—	—	1	—	—	—	—	—	—	—	5	1	—	—	—	2	—	—	1	—	—	—	1	1	36	41	
December ...	—	2	1	2	—	8	4	—	1	—	1	—	—	—	1	1	—	1	—	—	—	1	8	2	—	—	—	7	1	1	—	—	—	—	—	42	59		
TOTAL	2	12	3	36	1	162	75	3	1	12	14	8	1	6	32	10	3	4	2	1	1	16	88	19	1	6	53	4	1	7	5	2	11	13	615	315			

OUT-PATIENTS TREATED IN THE RIVER HOSPITAL EYE DEPARTMENT DURING 1938.

MONTHS.	EYE LID				CONJUNCTIVITIS	LACHRYMAL SAC	CORNEA						IRIS & CILIARY BODIES				CHOROID		RETINA	OPTIC NERVE				LENS AND VITREOUS						EYE-BALL				ORBIT				
	Blepharitis	Hordeolon & Chalazion	Trichiasis & Entropion	Tumour of the lid.			Conjunctivitis	Trachoma	Pterygium	Dacryocystitis	Keratitis	Ulceration	Perforation	Foreign Bodies	Corneal Wounds	Leucoma	Iridocyclitis & Iritis	Prolapse to Iris		Coloboma	Injury	Choriditis	Retinitis	Papilloedema	Neuritis	Injury	Atrophy	Cataract Congenital	Cataract Senile	Cataract Traumatic	Cataract Diabêtic	Capsule Tearing	Injury Panophthalmitis	Chronic Glaucoma	Sub-Acute Glaucoma	Injury	Cellulitis	Malignant Tumour
January	15	16	4	—	231	12	1	2	21	8	5	1	7	1	1	1	—	—	1	3	2	—	1	1	1	27	1	1	1	1	3	15	4	—	—	—	1	
February	—	11	3	—	195	22	4	1	—	—	6	5	3	3	2	—	1	—	—	4	1	1	1	3	5	3	—	—	—	—	2	16	2	—	—	—	—	
March	3	16	3	—	176	80	5	1	4	1	16	3	8	5	1	1	—	—	—	5	2	—	—	2	12	3	—	—	—	1	9	1	—	1	1	—	—	
April	5	11	5	—	216	92	7	—	1	—	9	13	5	1	4	1	—	—	1	2	—	—	—	—	1	14	1	—	—	—	1	14	1	—	1	1	—	—
May	8	7	3	—	146	63	2	2	3	—	16	15	1	1	1	—	1	—	1	3	—	1	1	2	14	2	—	—	—	—	1	16	1	—	1	1	—	—
June	2	13	3	—	156	108	3	—	1	—	4	10	6	1	1	—	1	—	—	2	2	—	—	1	8	2	2	—	—	1	15	1	—	2	—	—	—	
July	5	18	5	—	216	76	10	1	6	3	7	9	5	—	—	—	—	—	—	3	—	—	—	2	10	2	1	—	—	—	14	1	—	—	—	—	—	—
August	4	11	8	—	304	77	11	—	1	—	12	6	4	2	1	—	—	—	1	3	1	1	—	1	3	2	2	—	—	1	7	1	—	1	—	—	—	—
September	6	12	3	—	319	25	2	1	—	—	6	7	8	2	—	—	—	—	—	2	2	—	—	—	1	9	2	—	—	—	1	14	1	—	1	—	—	—
October	3	9	11	1	238	38	2	1	3	—	13	6	8	2	—	—	1	—	—	2	—	—	—	—	1	2	—	—	—	—	1	6	1	—	1	—	—	—
November.....	—	5	3	1	131	44	1	2	2	3	13	—	1	1	1	—	—	—	—	1	—	—	—	—	—	5	1	—	—	—	—	—	—	—	1	—	—	—
December	5	4	2	—	167	66	3	1	2	—	16	9	3	—	—	—	—	—	—	—	—	—	—	—	1	8	2	—	—	—	4	—	—	—	—	—	—	—
TOTAL	56	133	53	2	2,486	703	51	12	44	16	10	123	78	57	19	3	3	32	3	11	3	4	1	2	16	127	19	1	5	11	142	13	1	8	5	7		

MONTHS.	Muscles of the Eye	VARIOUS			Total New Cases	Total Attendances
		Strabismus	Refractions	Vision test for Medical Examinations.		
January ...	1	—	22	82	497	2,151
February ...	1	—	5	101	410	2,160
March ...	—	—	36	151	547	3,336
April ...	—	—	67	146	618	2,898
May ...	—	—	39	130	482	2,646
June ...	—	—	50	117	510	2,628
July ...	—	—	32	99	519	3,649
August ...	—	—	56	134	671	2,799
September ...	—	—	50	100	551	3,141
October ...	—	—	27	63	455	2,026
November ...	—	—	64	54	344	1,169
December ...	1	—	62	56	415	2,159
TOTAL	3	—	510	1,233	6,019	30,762
						6,019
						36,781

EYE OPERATIONS PERFORMED IN THE RIVER HOSPITAL DURING 1938.

MONTHS	CATARACT		GLAUCOMA				Trichloroacetic Acid	Iridectomy Optical	Enucleation	Pterygia	Staphyloma	Trichiasis	TUMOURS		Squint	Daeryocystitis	Lachrymal Cyst	Plastic Operations	Minor Operations	TOTAL
	Extraction	Needling	Trephine	Cyclodialysis	Filt. Iridectomy —rating	Iridenclisis							Innocent	Malignant						
January	5	3	—	4	4	—	—	—	—	2	1	2	—	—	1	—	—	2	26	50
February	6	3	—	—	3	—	6	5	—	3	2	8	1	—	1	—	—	2	19	59
March	10	2	—	1	4	—	—	4	1	2	2	7	3	1	—	—	—	1	42	80
April	12	7	—	—	10	—	—	1	—	3	—	3	1	—	—	—	—	2	24	63
May	14	7	—	1	9	—	4	4	—	1	—	2	—	1	—	—	—	1	30	74
June	14	11	—	—	9	—	—	4	2	—	4	3	—	—	—	—	—	4	24	75
July	10	6	—	—	6	—	—	3	1	8	2	4	—	—	—	—	1	5	27	73
August	19	2	—	—	7	—	—	3	—	3	—	16	—	3	—	—	—	—	26	80
September	5	6	—	—	1	—	—	5	1	3	—	13	1	—	—	—	—	1	22	59
October	9	3	—	—	1	—	—	1	1	2	—	3	—	—	—	—	—	3	28	52
November	5	4	—	—	2	—	1	1	—	—	—	4	1	—	—	—	—	1	24	44
December	11	14	3	—	1	2	—	5	—	7	—	9	—	—	—	1	—	4	24	83
TOTAL	120	68	3	6	57	2	11	36	6	34	11	74	7	5	2	1	1	26	316	792

REPORT ON THE STACK MEDICAL RESEARCH LABORATORIES FOR THE YEAR 1938.

BY DR. E. S. HORGAN

RESEARCH.

Malaria. The mosquito survey in the Gezira has been continued by Mr. Lewis and the scope of the work much extended, a summary of which will be found in the entomological section.

Dr. Kirk has completed his investigations, begun in 1937 (Report 1937), on the epidemiology of relapsing fever and his results have been published *in extenso* (Ann. Trop. Med. and Parasit. 1938 Vol. 32 p. 339). A short summary will be found in this report under the appropriate heading.

Apart from malaria, the main research commenced in 1938 has been on kala-azar and although the abnormally heavy rains during the summer have hindered the inception of a *Phlebotomus* survey, nevertheless a large amount of material has been collected by Dr. Kirk and Mr. Lewis, and is now being systematically examined.

The smallpox outbreak in the Gezira in the early months of the year called for a considerable quantity of vaccine lymph and opportunity was taken to carry out *ad hoc* research on various problems of mass production of vaccine lymph.

ROUTINE AND EDUCATIONAL ACTIVITIES.

A summary of the routine work is shown at the end of the report. The total 22,633 represents an increase of 2,000 specimens over the 1937 figure. The increases have been spread over most of the more important routine tests

especially Widal reactions, Kahn tests, and faeces examinations. The figure for the latter have been considerably increased, for the most part due to an increase in bacillary dysentery, probably in consequence of the heavy rains in Khartoum during the summer.

I have indicated my opinion in previous reports, of the importance of decentralization of a great deal of the simpler routine tests leaving the more complicated and technical procedures to be carried out in the Stack Laboratories and so allowing a larger proportion of the time of the staff to be devoted to research. It has been found somewhat unexpectedly that the development and opening up of new hospital laboratories has in some ways increased the work of the central laboratories as numbers of various specimens are now received from the Sudanese laboratory assistants throughout the provinces.

The development of aerial services on the south and west routes has also made a considerable contribution to this increase of routine work.

Hospital Laboratories. The number is now 24 and the total cadre of Sudanese laboratory assistants has increased from 28 to 30 ; their training is essentially that detailed in previous reports. The efficiency of these assistants judged from confidential reports from senior medical inspectors and from the personal acquaintance of the laboratory staff, is on the whole very fair, and in the case of the first half dozen very good. They appear however to be divided into two categories, the first continues to benefit from experience and from refresher courses, while the second appears to reach a certain level of efficiency at the end of the first training and henceforth to show little improvement. Sufficient time has not yet elapsed to say whether this apparent "stand still" is related to a previous deficiency in general education.

Staff Changes. Dr. Mansour Ali Haseeb did a three months special laboratory course in the Group Laboratories (L. C. C.) Archway Hospital through the kindness of the Director, Dr. J. M. Alston and on his return to the Sudan was promoted to the post of Assistant Bacteriologist.

Mr. N. Macdonald, Senior British Laboratory Assistant in the Wellcome Tropical Research Laboratories and Stack Laboratories for 24 years retired on pension, and his place was filled by Mr. A. Baillie, from the Department of Bacteriology, Edinburgh University.

ROUTINE EXAMINATIONS.

Pathological Specimens.

The total for the year was 476.

Post-mortem Examinations.

16 were carried out in Khartoum Civil Hospital, including 5 medico-legal, one of which was a suicide in which death was probably due to acute quinine poisoning.

NEOPLASMS.

134 were received of which 39 were benign and 95 malignant.

ORGAN OR TISSUE.	Carcinoma	Sarcoma	Total
Breast	8	1 (melanoma)	9
Female Genitals	5	0	5
Bladder	1	0	1
Prostate	1	0	1
Lip and Mouth	1	2 (1 endothelioma)	3
Liver	2	0	2
Anus	4	0	4
Eye and Orbit	5	5 (melanomata)	10
Maxilla	2	0	2
Face	1	1 (melanoma)	2
Neck	3	4 (endotheliomata)	7
Leg	3	2	5
Foot	0	9 (6 melanomata)	9
Arm and Hand	0	7 (endotheliomata)	7
Bone	0	1	1
Lymphatic glands	5	7 (1 endothelioma) (2 melanomata)	12
Abdomen	0	1 (endothelioma)	1
Spleen	0	1	1
Groin	0	2	2
Thorax	0	2	2
Site unknown	2	4	6
	43	49	92

Not included in the above list are, 1 perithelioma of the ankle, 1 atypical epithelioma, and 1 tumour of lung.

Comments. The atypical epithelioma was from the chest of an albino (male) and although further information has unfortunately not been available, the case is in all probability similar to those described in the 1937 Report.

The tumor from the lung obtained post-mortem in Khartoum Civil Hospital showed a highly atypical structure and Dr. E. C. Smith, Lagos to whom the section was submitted, suggested that it may have arisen from the thoracic sympathetic and could therefore be regarded a malignant neurocytoma.

Melanoma. No less than 15 were received and as in previous years the sole of the foot was a favourite site of election (6).

Carcinoma. Included under this head are 6 squamous carcinomata, the distribution being breast 1, leg 2, eye and orbit 2, bladder 1.

Liver. Both carcinomata were primary—the usual finding in the Sudan.

RABIES. 119 brains were received from all parts of the Sudan of which 11 arrived decomposed and useless for examination.

32 were positive for Negri bodies, the distribution being 25 dogs, 5 donkeys, 1 sheep and 1 jackal.

No human brains were sent for examination during the year.

Research work. Investigations commenced in the latter months of 1938 are still in progress. French writers have frequently drawn attention to the importance of periodical examination of all strains of fixed virus in laboratories, used for routine preparation of vaccine. The strain used in these laboratories is the Paris strain and was received some years ago from Dr. Stuart of the Public Health Laboratories, Jerusalem. So far as is known, the vaccine has never given rise to paralytic accidents and the incubation period in animals—sheep or rabbits, after sub-dural inoculation is absolutely constant at 6-7 days, the animal being practically always moribund between the 7th and 8th days. Examination of the hippocampi of some of these brains showed the presence of considerable number of typical Negri bodies and bearing in mind the curious variability in the Negriogenesis and virulence of strains of the Paris virus in different laboratories as discussed recently by Lépine (1938) (*Les Ultravirus des Maladies Humaines, Levaditi et Lépine. Paris*)—it was felt that the question deserved further investigation. One finding of some interest may be mentioned here; —Negri bodies are constantly present although in very varying numbers in all sheep examined, while the results have usually been negative with rabbits. With regards to the source of the inoculum there appears to be no difference in this respect between sheep or rabbit virus.

Rabies Vaccine. 61, 285 c.cms. were issued during the year. The method of preparation has remained unchanged.

RELAPSING FEVER. The Abyssinian strain of relapsing fever was found to resemble in its general features the other members of the North African group of louse borne strains.

After repeated unsuccessful attempts to culture on Yuan-Po's egg medium, it was successfully cultured on an improvised egg albumen-ascitic medium. Monkeys (*Cercopithecus sebaeus*) were the animals of choice for experimental infections, no loss of virulence being noted after three serial passages. In these animals splenectomy was found to influence the course of the first infection but had no effect on acquired immunity. It is interesting to note, in contrast to the results of Lipstein (1936), that the infection derived from the louse was more severe than that derived from the inoculation of infected blood. All attempts to transmit the infection by ticks (*Ornithodoros savignyi*) were unsuccessful.

KALA AZAR.

Work has been continued along the following lines.

Dermal leishmaniasis. The scarcity of parasites in the peripheral blood of cases in the northern Sudan has frequently been noted, and is an obstacle to the theory of transmission by a biting insect. Systematic examination of the skin, however, has revealed the presence of parasites in this tissue in several instances. In two cases an inconspicuous dermal lesion in which parasites were found, appears to have preceded the onset of generalised symptoms, and conditions comparable to the "post kala-azar dermal leishmaniasis" of Action and Napier have been recognised. When parasites are found in the skin, their distribution is patchy and the clinical lesions may be very small or inconspicuous.

Sandflies. Methods of collecting sandflies under diverse conditions have been evolved and collections have been made in various parts of the country throughout the year. A considerable amount of information on the distribution and bionomics of Sudan sandflies has already been obtained. Much of this information is entirely incidental from the point of view of kala-azar, but mention may be made here of the discovery of a sandfly of the major group (*P. langeroni*) in the three principal endemic areas; of the occurrence of two species (*P. adleri* and another, at present undetermined) which present certain features of resemblance to the South American sandflies; and of the recovery from animal burrows of most of the species known to occur in the Sudan.

Animals. Wild and domestic animals have been examined for leishmania infection. On account of the observations already described in connection with sandflies, and the local belief that the infection tends to cling to certain localised areas within the endemic districts, particular attention has been directed to small rodents and other animals which live in burrows. A visceral infection which terminated fatally was found in a monkey (*Cercopithecus sebaeus*) from Singa, but as this animal had been inoculated about a month earlier with blood from a patient with relapsing fever, doubts may be expressed with regard to the origin of this infection.

Serology. Napier's aldehyde test has proved so disappointing that it has been largely discarded as an aid to diagnosis in the Sudan. The fact that immigrants to the endemic areas appear to be more susceptible to the disease than the local inhabitants suggests the possibility of evolving a serological test to demonstrate the presence of immune bodies. Attempts have been made to adapt the adhesion test of Brown and Davies to the leishmaniasis, but up to the present the results have been unsatisfactory.

TRACHOMA. In collaboration with the Ophthalmic Surgeon, work in trachoma is in progress along three principal lines:

- (1) Morphological studies of the virus.
- (2) Serology, with particular reference to the Weil Felix Reaction, which Djourichitch and Loukitch (C. R. Soc. Biol. 1938 Vol. 128, 832.) have found positive in a significant proportion of cases of trachoma in Belgrade.
- (3) Chemotherapy. Interesting results have been obtained with Sulphanilamides in trachoma, similar to those reported independently by Lian (Genesesk. Tijdschr. Ned-Ind., 1938, 78; 1025), from the Dutch East Indies, and by Loe (J. A. M. A., 1938, 111, 1,371) from the United States of America. A preliminary report of this work has been published (Kirk, McKelvie and Hussein Ahmed Hussein, Lancet 1938, II. 994).

YELLOW FEVER. Examination of livers (viscerotome specimens) from fatal cases of obscure fever and jaundice.

6 were received during the year, all were negative. One of these cases was of some interest, as the district from which the patient came gave 5 out of 27 positive mouse protection tests a few weeks previously. The patient (native) was admitted into Juba Hospital on 5.11.38 with jaundice and fever and became comatose 24 hours after admission with signs of cerebral irritation. The cerebro-spinal fluid was taken the following morning but showed nothing abnormal. Blood films for malaria were also negative. On 8.11.38 his condition was much worse with incontinence of urine and faeces and vomiting. The vomit was black, there was also bleeding from the nose and bloody diarrhoea as in purpura. The general condition became rapidly worse and death took place the same day. According to the calculation of the Senior Medical Inspector, Juba, to whom I am indebted for these notes, the illness had lasted between 5 and 7 days. The temperature ranged about 100° F. until just before death when it rose to 104° —the pulse rate varied between 90 and 112; Faget's sign was negative. Unfortunately it was not possible to carry out a post mortem examination but a viscerotome specimen of liver was secured. The histological report is as follows: "The liver shows an extensive destruction of its parenchymatous cells the normal structure being almost completely lost, and such necrotic changes appeared to be uniformly distributed. There were no definite areas of haemorrhages although a good many red blood corpuscles were present in the sinusoids. Infiltration of lymphocytes and mononuclear cells was present in Glisson's capsule and marked in some areas but there was no infiltration between the columns of liver cells.

There was no hyaline necrosis and no fatty degeneration."

It will be seen that the above picture was quite unlike that of yellow fever but corresponds rather with that seen in cases of the so called acute necrosis or acute yellow atrophy of the liver (Report 1936).

Mouse Protection Tests.

(a) SURVEY. In view of the positive tests, 9 out of 34 in Malakal in 1937, (Report 1937) a fresh survey was undertaken and 114 sera were sent to Dr. Findlay for examination. He reported that 21 or 18.4 per cent. of these protected. An analysis shows that 8 of these had lived in Malakal all their lives and 7 of the 8 were under 15 years of age, the two youngest being 8 and 6 years respectively.

(b) CASES OF OBSCURE FEVER AND JAUNDICE. The sera from 9 cases, 5 of which were from Malakal, were examined on two occasions—the first during the early days of the disease, the latter 10 to 20 days afterwards, when the patients had become convalescent. An examination of the results showed that all sera were negative (mouse protection tests) on both occasions; 1 serum was positive on both occasions, but as the first specimen was not taken until the second week there is no evidence that any relation existed between the illness and the positive results. Of 3 cases of fever and jaundice examined (one specimen) in the second week 2 were negative and one positive; again there is no significance in the latter result. Considering the above evidence together with that presented in previous reports it seems reasonable to draw the following conclusion: the cases of jaundice and fever which commonly occur throughout the Sudan and which vary from mild clinical attacks to cases with marked jaundice, black vomit, haemorrhagic lesions and rapidly fatal outcome, are not yellow fever.

ENTERIC FEVER.

There was the usual preponderance of *B. typhosum* of which 98 strains were isolated in blood culture compared to 4 of *B. paratyphosum* A and none of *B. paratyphosum* B. No inagglutinable (Vi) strains were found during the year.

Salmonella Food Poisoning. It was hoped to have identified fully the *Salmonella* organism isolated in December, 1937 from the Malakal outbreak (Report 1937) but although a good deal of work was carried out on it, complete identification was not possible partly owing to the lack of some of the necessary sera and partly owing to pressure of other work. Sufficient has been done to show it is a new type not falling into any of the existing *Salmonella* types. It has been provisionally named *B. Malakal* and its formula is tentatively represented as follows: (Kauffmann-White Scheme).

O antigen	H antigen
III	specific
	? ?
	non specific
	1, 2, 3; (4), (5)

With regard to the O antigen it is closely related to *B. senftenberg* and *B. newcastle* but appears to be completely lacking in O antigen 1 as there is no trace of cross agglutination between it and *B. paratyphosum* A. So far a specific (H) phase has not been detected and in its non-specific phase it appears to share most of the main antigens. *

DIPHTHERIA.

Advantage was taken of the occurrence of a certain number of cases and carriers during the latter months to investigate the prevalent type of *C. Diphtheriae*.

31 Strains were examined—all were of the *Mitis* type, although one curious fact was noted; several of the strains, when freshly isolated, fermented starch slightly but after one sub-culture this property appears to have been permanently lost. In every other way the strains were typical of *Mitis*. These recent results are in accordance with the previous work in 1932 when Horgan and Marshall (J. of Hyg. 1932 Vol. 32) found 18 out of 22 strains from cases and carriers were *Mitis*.

All available evidence for the past 5 years goes to prove the extreme rarity of *Gravis* type in the Sudan.

VACCINE LYMPH.

During the year 80 calves and 3 sheep were used. The yield from 4 calves was dry and scanty and was discarded. The total yield was 3439 gms. the average being 44 gms. per calf and 28 gms. per sheep.

1,300,000 doses were used although it was calculated that only about 500,000 doses would be required. The increase was due to an outbreak of virulent smallpox in the northern Gezira and in consequence of which a thorough vaccination was carried out of all villages in the northern Gezira and of the population along the banks of the Blue and White Niles in the contiguous areas. The outbreak and results of vaccination have been reported (Horgan and Goss 1938 Bull. Off. Int. d'Hyg. Pub. 30 No. 8 p. 1690).

In consequence of the abnormal demands for lymph, the accumulated stock was exhausted and it was necessary to issue lymph of recent manufacture.

*The strain has been submitted for full serological analysis to Dr. W. M. Scott—Ministry of Health who has kindly furnished a preliminary note—"A specific phase has been detected which appears to be identical with that of *Bact. Bareilly* (y)."

To reduce the high bacterial count the method, as detailed in the 1937 report, of treating with chloroform vapour was used, the lymph being then tested both bacteriologically and for potency. It was found necessary with most recent batches to increase the time of contact with the chloroform vapour, the usual procedure being to repeat the process on two successive days. This treated lymph when used fresh gave a high percentage of takes. However when used later in the year after 3 or 4 months storage in a refrigerator at about 4°C. the results were disappointing and all unused batches were recalled from hospitals and large numbers of samples retested together with some of the unused stock. The potency without exception was very poor, most batches showing isolated vesicles at 1 in 1,000 and negative at 1 in 10,000. It is to be noted that such would still fulfil the requirements of the Therapeutic Substances Act (1925).

DRY LYMPH.

In view of the stability of dried lymphs exposed to high air temperatures (Report 1937) its study was continued. The obvious disadvantage of freezing and drying the crude pulp is that most of the bacteria, especially the streptococci and staphylococci, remain viable also, with consequent risks of infection when the lymph is used. In an attempt to overcome this a series of batches were ground with distilled water (1 in 3) instead of the usual glycerine mixture and exposed in the usual way to chloroform vapour. The lymph was then frozen and dried, first over calcium chloride and finally over phosphorus pentoxide and tubed *in vacuo* in the usual way.

In seven batches so treated, potency tests showed a confluent or semi-confluent take at 1 in 10,000 and a few vesicles at 1 in 100,000, but when tested for issue after 6 months storage in the refrigerator the results were very disappointing, only two of the batches satisfying the standard, the others showing only a few vesicles at 1 in 1,000. It will be seen that the results are similar to those mentioned above, of the glycerinated lymphs treated with chloroform vapour.

All batches were repeatedly tested for traces of CHCl_3 vapour before storage, and in all the result was negative. Even assuming that undetected traces of CHCl_3 were sufficient to damage the potency of the glycerinated lymphs, it seems highly improbable that such was the case with the dried lymphs.

As a considerable quantity of lymph had to be destroyed, it was thought that a brief description of these recent experiences with chloroformed lymphs might be of interest to workers in other lymph institutes. They corroborate the earlier results of Green and other workers as to the advantages and disadvantages of the chloroform method; that lymphs so treated are of great value when used fresh as under epidemic conditions but that under no circumstances should such lymphs be stored—*dry or glycerinated*—even under the most perfect conditions of refrigeration.

Biological test for smallpox. The outbreak afforded an opportunity to repeat the work of McKinnon and Defries 1928 (Amer. Journ. of Hyg. Vol. 8 p. 93) on the diagnostic value of intradermal inoculation of smallpox material into rabbits.

The technique of these authors was closely followed—the material used (12 cases) being either freshly collected pus from the vesicles and pustules, or moist, or dry scabs. The majority of the specimens were inoculated into each of 4 rabbits, two being normal and two previously vaccinated being immune.

The statement of McKinnon and Defries that smallpox injected intradermally into normal rabbits provokes a definite specific lesion was in the main confirmed. The peak of the reaction was however more variable and earlier, in most cases ranging between 48 and 72 hours as compared to the 4th day found by the American workers, while fading took place rapidly and was complete by about the 7th day.

With most of the specimens of virus, inoculation was carried out on two rabbits and in general there was fair agreement between the strengths of the respective reactions ; however the pus freshly collected from 3 cases of smallpox was completely negative.

The scabs from four cases of chicken pox were used as controls ; with two the results were completely negative, while two gave a marked reaction within 24 hours (on both immune and non-immune rabbits), developing into pustules from which *Staphylococcus aureus* was isolated.

The allergic reaction of the smallpox virus on the immune animals proved so variable as regards both time and strength that it certainly could not be used as a basis of comparison as suggested by the above authors. Taking into consideration the variable strength of the reaction even in non-immune rabbits, the negative results from three undoubted cases of smallpox and the difficulty of interpretation in several of the reactions complicated by a staphylococcal infection it is very doubtful if the reaction would be of any value as a routine diagnostic test.

Variola-Vaccinia variation.

After several failures, this was effected with one specimen of variola pus using monkey passage followed by serial intratesticular passage in rabbits. The results have been published in full (Horgan 1938—J. of Hyg. Vol. 38 p. 702).

SUMMARY OF ROUTINE EXAMINATIONS.

Blood Kahn tests	13,339	Throat Swabs :	
Blood Widal Reactions	1,396	<i>C. diphtheriae</i> positive ...	146
Blood Cultures	524	„ negative ...	1,603
Blood Films	1,863	Sputa :	
Cerebrospinal Fluids	45	T. B. positive	7
Biochemical Tests	104	T. B. negative	42
Autogenous Vaccines	5	Spleen Smears :	
Pathological Histology (including brains for Rabies)	476	(Kala azar positive) ...	6
Faeces	1,804	General Bacteriology ...	251
Urine	865	Water examinations ...	157

Summary of Faeces Tests.

<i>Bact. flexneri</i> isolated...	64
„ <i>shigae</i> „ ...	16
„ <i>ambiguum</i> „ ...	4
<i>B. typhosum</i> „ ...	122
<i>B. paratyphosum</i> A „ ...	1
Amoeba present	22
Ova present	52
Negative	1,523

Summary of Urine Tests.

<i>B. typhosum</i> isolated...	63
<i>B. paratyphosum</i> A. „ ...	1
Ova present	11
Negative	790

Summary of Examinations of Blood Films for Parasites.

Malaria :

Benign Tertian	...	65	Relapsing Fever	...	...	2
Subtertian	...	467				
Quartan	...	10	Negative	...	...	1,318
Double Infections (M.T./Q.T.)	...	1				

Summary of Widal Reactions.

<i>B. typhosum</i>	...	213	<i>Br. Melitensis</i>	...	...	40
<i>B. paratyphosum</i> A.	...	1	Negative	...	...	1,142
<i>B. paratyphosum</i> B.	...	0				

Summary of Blood Cultures.

<i>B. typhosum</i> isolated	...	98	Other organisms isolated	...	16
<i>B. paratyphosum</i> A.,,	...	4	Negative	...	399
Streptococci	...	7			

Total Examinations for 1938 = 22,633

REPORT

ON

MEDICAL ENTOMOLOGY

INTRODUCTION.

The present is a resumé of the work of the Entomological Staff detailed for Medical Entomology and covers the period January to December 1938.

Mr. F. G. S. Whitfield who for the past three years had been engaged in the study of various local problems of medical entomological importance, in addition to his duties as lecturer in biology at the Kitchener School of Medicine, resigned his post in May, 1938. During this period he completed a three years survey of insects collected from aircraft in Khartoum, carried on the mosquito survey of Khartoum and was engaged in a study of the local problem of *Chironomids*, with a view to finding out practical measures for their control. The two former activities have now been taken over by Mr. D. J. Lewis and are being continued, in so far as is possible, under his supervision with the assistance of native staff.

Mr. Lewis has continued his survey of the mosquito problem in the Gezira and the Sennar Reservoir and is now carrying out a similar survey in the White Nile Reservoir.

The more general survey of insects including mosquitoes and related pests of medical importance from various parts of the Sudan has been continued and has entailed considerable work in identification. A start has been made in the study of *Phlebotomus spp.* in collaboration with the staff of the Stack Medical Research Laboratories in connection with the incidence of kala-azar.

MOSQUITO SURVEY.

THE GEZIRA AREA.

STUDY OF THE BIONOMICS OF ANOPHELES GAMBIAE.

Work in the Gezira has reached a stage when further knowledge of the bionomics of the larvae and adults of *Anopheles gambiae* is necessary. A particularly important question concerns the length of life of the adult mosquito.

In several countries it has been found that increased temperature, although accelerating the development of the malaria parasite in the mosquito, may shorten the life of the host and therefore lessen the amount of transmission of malaria. This sort of effect may result from the two annual hot seasons in the Gezira.

With the object of studying this and other problems attempts have been made to start a cage colony of *A. gambiae*, as has previously been done in Dakar by Mathis (C. R. Soc. Biol., 121 pp. 21-22. 1936) and in Johannesburg by De Meillon (Nature 140, p. 428. 1937), who employed guinea pigs and pigs as hosts for feeding the mosquitoes. Attempts to induce the local *A. gambiae* in the Gezira to feed on these animals have failed, and resort has had to be made to the human host. Fertilized eggs have been obtained and the experiments are being continued.

Daily collections of *A. gambiae* were made in temporary huts inhabited by cotton pickers from January to March. At first, when fourth stage larvae were scarce, over 400 adult mosquitoes could be found in a single hut. In February, when larvae became commoner, adults became very scarce. This confirms the finding of the previous year that the number of adults is often in inverse proportion to the number of larvae, a fact which may be due to the abovementioned effect of temperature.

THE WHITE NILE RESERVOIR.

Three rapid tours have been made in the area between Jebelein and Jebel Aulia during December, 1937 and September and December, 1938. A general survey is being made with the object of observing the effect of changes of the river level on the mosquito fauna, so that, should conditions change for the worse, methods of control may be introduced to meet them, or possibly applied in advance before such changes have occurred.

The species recorded from the reservoir so far number twenty-five, as is shown in the table below. Of these ten species were not recorded prior to 1937 or 1938, and it may therefore be assumed that some of them have spread from the south owing to the changing conditions. Apart from known or potential carriers of malaria the fauna includes species which are potential vectors of dengue, yellow fever or filariasis, should these diseases ever reach the district. There are in addition several species which are very troublesome biters both by day and night, notably *Culex poecilipes*, *Taeniorhynchus uniformis* and *T. africanus*.

MOSQUITOES IN RELATION TO MALARIA.

Anopheles gambiae is the principal vector of malaria in the Sudan and now occurs throughout the reservoir area. Its importance and breeding habits are such that its control must be considered as a problem distinct from that of other species.

Anopheles pharoensis breeds in most parts of the area and bites fiercely. It has been found infected with malaria in several countries but its importance on the White Nile is still unknown. Work on the general bionomics, infection rate and feeding habits of this species are essential before conclusions can be reached regarding our attitude to the vast swamp in which it breeds.

Anopheles wellcomei was observed at Kosti for the first time in 1938, and being a southern species it is possible that it has spread northwards with the changing conditions.

Henderson and others record it as a voracious biter out of doors during the day. No dissections of this species for malaria parasites have been recorded and Evans considered that it might be unimportant as a carrier owing to its outdoor habits. In the Blue Nile Province, however, it has been found in houses. The egg, larva, pupa and male of this mosquito are still unknown, a fact which is delaying the making of a survey of breeding places in the Kosti area. Females were collected in order to obtain eggs and breed the early stages.

Anopheles rufipes is common in certain areas but its importance is unknown.

Of other species *A. coustani*, *A. squamosus* and *A. nili* are at present too rare to be important. These and all other species of *Anopheles* with the exception of *A. gambiae* may, until more is known about them, be grouped as swamp-breeding species which may or may not transmit malaria, but are likely to be of far less importance in this respect than *A. gambiae*.

THE INFLUENCE OF AQUATIC FLORA ON MOSQUITO POPULATION.

A study of the aquatic flora is of considerable importance since some species of mosquitoes are more or less restricted to certain plants. A striking feature of such flora is the very large number of species.

In this connection the region may be divided into three areas:—

(a) From Jebelein to Kosti Bridge.

There is no great malaria problem in this area because it is sparsely inhabited, but it indicates what conditions may develop further down stream, and is useful for studying the mosquitoes and plants which are already invading reaches of the river north of Kosti (e.g., *Taeniorrhynchus africanus* and *T. uniformis* are common at Jebelein but rare at present at Kosti, and *A. wellcomei* occurs near Ez Zuleit).

This stretch of river is lined for many miles with vast marginal swamps often several hundred metres in width. These consist mainly of a dense tangle of submerged and floating vegetation in about 2 metres of water, fringed on the river side with a more or less continuous line of stranded Papyrus. Collections made in some of these swamps revealed remarkable scarcity of mosquito larvae in the dense masses of *Ceratophyllum demersum*, *Naias pectinatus* and other plants, which appeared ideal breeding places. Few adults were seen at night when the steamer was anchored, and on the one occasion near Kosti bridge a dinghy was rowed into a swamp at 6 p.m., on a calm evening and not a single mosquito seen. In the same swamp three species of small carnivorous fish were found to be common, two of which have the habit of penetrating thick surface vegetation.

One of the latter has been determined as *Haplochilus marni*, Geoff, a member of the family *Cyprinodontidae* which also contains the well-known *Gambusia spp.*, exported from America to several countries for mosquito control.

(b) Between Kosti and Dueim.

The region shows a gradual transition from the Kosti area, with its marginal swamps fringed with Papyrus and *Pistia* and submerged islands covered with vegetation, to the Dueim area in which the Papyrus and swamps are replaced by a few isolated Papyrus plants and patches of *Naias* and *Ceratophyllum sp.*, with the islands too deeply submerged to support much aquatic vegetation.

Anopheles gambiae is common in this area and breeds principally in marginal pools, flooded khors and areas of *Naias* near villages and towns. The marginal pools are a characteristic feature when the water level is constant. They are formed by the action of the waves which build up small banks enclosing either pools of water on the shore or small khors. These pools are usually only about a metre in diameter but breed large numbers of *Anopheles gambiae*.

A. pharoensis and other species breed in the swamps and islands.

The conditions near the chief towns and villages vary considerably and each will have to be considered separately. At Kosti the more notable features are the recent arrival of *A. wellcomei*, referred to above, and the fact that in winter most of the mosquitoes breed very sparsely in large swamp areas. At Kawa and Gulli breeding of *A. gambiae* takes place in flooded khors. At Kawa during the rains the khor covers an area of several feddans and is almost completely surrounded by houses, extending between the latter into the streets where breeding also takes place. At Dueim the principal breeding places of *A. gambiae* are marginal pools and areas of *Naias*, which reach the surface of the water in January. With regard to the Abu Gassaba basin, it remains to be seen what water plants colonise this area and what species of mosquitoes appear.

(c) Between Bakht er Ruda and Jebel Aulia.

The characteristic features of this reach are the steep shore and sand dunes on the east bank, the extensive shallow water areas on the west and the fact that the only common mosquito is *A. gambiae*. The latter breeds in the marginal pools and khors such as occur at Geteina and Fetisa. *A. pharoensis* breeds in a few khors in the rains. The shallow water on the west bank contains few plants except 'seid' grass (*Cyperus rotundus*) and very few mosquitoes. It remains to be seen what other plants, if any, colonise these extensive areas. A possible ominous sign was the finding in December of a small patch of *Naias* and *Echinochloa* sp. in one of the areas.

It is of interest to note that of the irrigation schemes along the White Nile some are surprisingly free from mosquitoes, although *A. gambiae* was on occasions found breeding in seepage water from canals.

Conclusions.

No general conclusions can yet be drawn, since the conditions which have to be considered will not exist until possibly 1943 or later*. There is much material yet to be examined and continuous observations are required to note the changes as they take place and the effect of such changes. With regard to the control of *Anopheles* there are two distinct problems.

(a) The control of *A. gambiae*.

(b) The question of *A. pharoensis* and other swamp-breeding species.

In connection with (a) it should prove possible to exercise considerable control in its chief breeding places such as marginal pools, khors and patches of *Naias* near villages. Many marginal pools could be filled in. Paris green, which is being prepared in the sanitary store at Dueim should prove useful in *Naias* areas and certain khors. In the Kosti-Shawal area, when the reservoir reaches full level the gradually sloping shore might, near villages, be converted into a definite bank by piling up Papyrus plants.

In respect of the second problem (b) further information is required on the bionomics of the various species concerned.

* When the reservoir above Jebel Aulia Dam first reaches full level.

THE SENNAR RESERVOIR.

As in the White Nile Reservoir the problem of mosquito control falls under two headings.

- (a) Control of *A. gambiae* in localised breeding places.
- (b) Control of *A. pharoensis* and other species in the extensive masses of floating *Echinochloa* grass.

In the latter areas over 99% of the Anopheline larvae are *A. pharoensis*. Its role in the transmission of malaria in this district is doubtful and owing to its numerical preponderance in this and other areas, more definite knowledge of its bionomics is required.

With this object the village of Hassan near Sennar has been selected as a suitable place for observations. It has three necessary requirements, namely, sufficient numbers of *A. pharoensis*, the presence of *A. gambiae*, a well-known malaria-carrier, for purposes of comparison, and a sufficient number of gametocyte carriers in the population. The latter fact was ascertained by a survey undertaken by staff of the Stack Laboratories.

Work at Hassan village is taking the form of general collecting of larvae and adults of *A. pharoensis*, to find its seasonal variation in numbers, dissections of adults and a study of its habits.

With regard to the number of adult *A. pharoensis* in the village there are three well marked periods:—

- (a) July 15th to end of September.

Adults become numerous from the latter half of July onwards and migrate to the village, biting fiercely by night and resting by day in herbage near the huts. Large numbers of fully fed adult mosquitoes thus accumulate in the vicinity of the village, the females probably only leaving it to lay eggs.

The period ends abruptly as soon as the herbage dries up through lack of rain and the resting places of the adult mosquitoes are destroyed. Even then the adults seldom rest in houses by day, which is a marked characteristic of this species in this area.

In conclusion one may say that this is the only period in which adult *A. pharoensis* are common in the village and in consequence likely to transmit malaria. Furthermore it coincides with the greatest incidence of *A. gambiae*.

- (b) Beginning of October to Mid-January.

During this period the numbers of *A. pharoensis* rapidly decline, very few appear in houses, and the majority resort to the only available thick vegetation, namely herbage and bushes on the old 420.70 metres shore line which is several hundred yards from the village.

- (c) Mid-January to Mid-April.

Adults are more numerous and some reach the village. Finding no sheltering herbage nearby they occasionally rest by day in the thatched shelters attached to houses and used by goats and fowls. At this time the reservoir level falls and near the edge masses of *Naias*, *Echinochloa*, and *Vossia* become stranded on and draped over submerged sticks and dura stems, thus forming tent-shaped shelters under which *A. pharoensis* adults rest in large numbers. These resting places are even further from Hassan village than those used in October.

With regard to the feeding habits of this species, females bite humans very readily. Blood is being collected from the stomachs of recently fed adults so that it can be subjected to the precipitin test to determine the degree of preference for human or animal blood.

Dissections of 73 *A. gambiae* and 23 *A. pharoensis* from Hassan village were made during the rains but no sporozoites were found in the salivary glands.

With the object of carrying out experimental infections of the latter species with malaria attempts are being made to breed it under controlled conditions so that uninfected specimens may be available.

The conclusions drawn are that although in this area *A. pharoensis* is never so closely associated with man as *A. gambiae*, it may be sufficiently numerous in villages at certain places and seasons to transmit malaria. This depends on various factors such as distance of villages from the water, state of the vegetation and conditions in the breeding area.

It is of interest to note that the spread of *Echinochloa* in this area, which until 1936 had been rapid, is now slowing down owing to the steady but slow natural process of sedimentation which is taking place as the result of the annual accumulation of dead grass. That such is actually occurring has been shown by observation of a small area of dry land formed in August 1937 which had by 1938 increased in size.

KHARTOUM.

A mosquito survey in Khartoum and its immediate vicinity was carried out in collaboration with the Medical Officer of Health. The specimens bred and collected from this area during 1938 included 13 species which are listed in the table given on p. 90 together with the 26 previously recorded species.

Under present conditions of sanitation *Anopheles gambiae* is the only species which is normally of any importance, but owing to the exceptional heavy rains of 1938 other species reappeared. A marked feature at present is the scarcity of mosquitoes belonging to the Sub-genus *Stegomyia*. In spite of the heavy rains only 4 specimens of *Aedes aegypti* and 2 of *A. metallicus* were found.

KASSALA PROVINCE.

A brief survey of mosquitoes was made in the Kassala District and along the upper reaches of the River Atbara in the Gedaref District. In the latter region *Anopheles funestus*, Giles. was found breeding in considerable numbers at Hillet el Hakuma, Wad Arud and other places along the river. This is one of the most northerly limits of distribution of this important species.

SURVEY OF KNOWN AND POTENTIAL CARRIERS OF YELLOW FEVER.

This survey was continued and determination of species contained in the Sub-genus *Stegomyia* included 1,858 *Aedes aegypti*, L., 421 *A. vittatus*, Bigot., 9 *A. metallicus*, Edw. and 5 *A. simpsoni*, Theo.

Several specimens of the pale form of *Aedes aegypti*, previously only found at Port Sudan, were received from Suakin and Tokar. This variation has never been seen in specimens other than those collected along the coastal plain. In many such specimens some of the scales are cream coloured or golden brown instead of the normal black, with the result that the mosquitoes superficially resemble species of *Culex*.

NEW RECORDS OF DISTRIBUTION OF THE SUDAN.

Specimens of *Theobaldia longiareolata*, Macq., a species previously only recorded from Dongola and Wad Medani, were received on several occasions from Port Sudan.

A new record for the Sudan is *Megarhinus brevipalpis*, Theo., a specimen of which was submitted for identification by the Medical Inspector, Sources Yubo. The species belonging to this Genus have carnivorous larvae, which in Fiji are employed for controlling *Stegomyia* sp.

It would appear that *Anopheles rupicolus*, Lewis, which was described last year from specimens collected at Jebel Moya, has a comparatively wide distribution and is now recorded as occurring at Kassala, Talodi and Torit, as well as in Sinai.

SURVEY OF OTHER INSECTS AND RELATED PESTS OF MEDICAL IMPORTANCE.

BUFFALO GNATS OR "NIMITTI" (*Simulium* spp.).

A breeding place of *Simulium damnosum* was found at Sennar in March and afforded an opportunity of studying certain habits of this important species. *Simulium griseicollis* was found to occur at Jebel Aulia but it is not yet known whether it has been able or not to breed there since the construction of the dam.

SANDBLIES (*Phlebotomus* spp.)

More attention has been given to the survey of *Phlebotomus* spp. in relation to the incidence of kala-azar. The work is being done in collaboration with Dr. Kirk of the Stack Medical Research Laboratories. Expeditions were made to places in the south of Kassala and Blue Nile Provinces where kala-azar has been known to occur, including Wad Arud on the River Atbara, Gedaref and Singa. One interesting discovery was the finding at Singa of *Phlebotomus langeroni* Nitz., a species belonging to the *P. major* group, of which specimens have now been collected in three widely separated localities where kala-azar occurs, namely Kapoeta, El Fasher and Singa.

During these expeditions new technique was devised and tested for studying and collecting these insects with the result that information was acquired on the biology of several species.

Observations have also been conducted at Wad Medani on the various species which occur there, including *P. papatasi* Scop., *P. schwetzi*, Adl, Theodr. and Parrot (a species known to bite humans), *P. africanus*, Newst., *P. squamipleuris*, Newst., *P. minutus*, var. *signatipennis*, Newst. and two undetermined species, one of which has proved on examination to be new to the Sudan.

OTHER INSECTS AND RELATED PESTS OF MINOR IMPORTANCE.

The tick *Ornithodoros savignyi*, And., sometimes regarded as a potential vector of relapsing fever, is recorded from Wad Medani for the first time, where it was found in a cattle enclosure in such large numbers that several kilograms of ticks were collected in a few minutes.

Another interesting record concerns *Hyalomma aegyptium*, L., the common animal tick of the Northern and Central Sudan, which is reported as attacking humans in houses in Wad Medani in consequence of the removal from their enclosure of cattle on which it normally fed.

Iiponysus bursa, Berlese, normally an ectoparasite of birds is recorded as attacking humans at Malakal. Similar observations regarding this species have been made in India and Zanzibar.

INSECTS FROM AIRCRAFT.

The collection and determination of insects from aircraft arriving at Khartoum has been continued in collaboration with the Public Health Service.

The records for 1938 include no insects of abnormal interest and the results of the past three years' survey, which was completed in August, are being written up by Mr. F. G. S. Whitfield and will shortly be published.

We are greatly indebted to the Director of the Imperial Institute of Entomology who arranged for the determination of most of the insects collected.

INVESTIGATIONS INTO CONTROL MEASURES.

MOSQUITO CONTROL.

Further work has been done in connection with the control of mosquitoes in the Gezira by the application of Paris green dust.

The exceptionally heavy rainfall during August in and around Khartoum was responsible for extensive floods to the south of the town, in which mosquito breeding eventually took place. With a view to ascertaining the feasibility of controlling such breeding (should it occur in future years), by dusting with Paris green from the air, an experiment was carried out in the Sennar Reservoir in cooperation with officers of the Royal Air Force and interesting results were obtained.

A study is being made of the habits of various species of fish which feed on insects and more especially the immature stages of mosquitoes. One species on which observation are being made is *Clarias anguillaris*, L., locally termed "garmut", which is now being used in Dongola for controlling mosquito-breeding in wells.

The various species of fish are being classified according to their avidity for the immature stages of Anopheline and Culicine mosquitoes and their ability to reach them in their natural breeding haunts.

EXPERIMENTS IN CONNECTION WITH THE CONTROL OF CHIRONOMIDS IN KHARTOUM.

BIONOMICS. Gardens in the near vicinity of the Blue Nile are annually subject to periodic invasions by countless myriads of small gnat-like flies belonging to the family *Chironomidae*. These flies which include more than one species are readily attracted to artificial light in gardens and houses, around which they swarm in the evenings and in this way are a constant source of annoyance to the occupants. Breeding takes place in the river and the immature stages are to be found in the silt which collects in the shallower parts of the Blue Nile as the river falls. Attempts were made to ascertain whether emergence of the flies from the pupal stage takes place from the water-surface or the mud flats which become exposed as the river recedes. From observations made it would appear that the latter method is the more usual.

With a view to ascertaining whether there is any correlation between the absence or abundance of these flies in gardens and the periodic rise and fall of the river, an attempt was made to record the abundance or otherwise of the flies in gardens throughout the affected regions, and tenants of the houses concerned were asked to make daily records for this purpose. The results obtained were unsatisfactory however owing to discrepancies in recording.

EXPERIMENTAL CONTROL. With a view to finding an effective and at the same time practical method of control two different experiments were carried out which are summarized below :—

(a) Oiling the foreshore as the river receded with a view to destroying the adult flies before emerging from the pupal case.

The initial trial was made with waste oil supplied by the Mechanical Transport Department of the Sudan Defence Force. Owing to the thickness of the oil there was considerable difficulty in getting it to spread which increased the cost of application. A more suitable substitute was obtained in the form of a waste product prepared by the Shell Co., which was found possible to apply by means of watering cans.

A preliminary trial was carried out on a small plot of wet mud bordering the White Nile near the Sunt Forest and later extended to the strip of foreshore stretching from the Palace to the Blue Nile bridge.

The results of this treatment were undoubtedly effective in that large numbers of dead *Chironomids* were found on the treated mud flats. The beneficial affect however was only temporary for as soon as the river receded further and fresh expanses of mud were exposed and the emergence of *Chironomids* restarted. It would therefore be necessary to apply such treatment more or less continuously so long as the river continues to fall.

A very approximate estimate of cost of such application along the south shore of the Blue Nile from the Blue Nile bridge to the Mogren would be £E. 800 for one season. More than twice this amount would be required to include control measures on islands, mud and sand banks and the north shore.

(b) The use of acetylene flares for attracting and destroying the flies collected in gardens. Trials were made with two flares. It was found that when used with the tin reflectors the flares projected too strong and narrow a beam of light in which the flies tended to collect and dance without being destroyed.

Although better results were obtained without the reflectors it was concluded that control along these lines would be very expensive.

COLLECTIONS RECEIVED FOR DETERMINATION.

During the year collections of insects of medical importance have been received from many parts of the country. A total of 4,733 specimens have been examined including mosquitoes, tse-tse flies, *Phlebotomus*, *Tabanidae*, fleas and various other insects, ticks, mites and fish.

Much time has also been spent in preparing collections for purposes of exhibit.

Species of Mosquitoes recorded from the White Nile Reservoir prior to and since 1936 and in Khartoum prior to and during 1938.

SPECIES.	White Nile Reservoir		Khartoum District	
	Records prior to 1936	Records since 1936	All Records	Records in 1938
<i>Anopheles gambiae</i> , Giles ...	x		x	x
<i>A. pharoensis</i> , Theo. ...	x		x	x
<i>A. rufipes</i> , Gough. ...		x	x	
<i>A. pretoriensis</i> , Theo. ...			x	
<i>A. squamosus</i> , Theo. ...		x	x	x
<i>A. coustani</i> , Lavern ...		x		
<i>A. nili</i> , Theo. ...		x		
<i>A. wellcomei</i> , Theo. ...		x		
<i>Theobaldia longiareolata</i> , Macq.			x	
<i>Taeniorhynchus uniformis</i> , Theo.	x			
<i>T. africanus</i> , Theo. ...		x		
<i>T. aurites</i> , Theo. ...	x		x	
<i>T. microannulatus</i> , Theo. var. <i>auripennis</i> , Edw. ...		x		
<i>Aedomyia africana</i> , Neveu-Lemaire ...		x		
<i>Ficalbia splendens</i> , Theo. ...		x		
<i>Aedes lineatopennis</i> , Ludlow ...			x	x
<i>A. scatophagoides</i> , Theo. ...			x	x
<i>A. vittatus</i> , Bigot. ...	x		x	
<i>A. luteocephalus</i> , Newst. ...	x			
<i>A. aegypti</i> , L. ...	x		x	x
<i>A. simpsoni</i> , Theo. ...			x	
<i>A. metallicus</i> , Edw. ...			x	x
<i>A. unilineatus</i> , Theo. ...	x			
<i>A. argenteopunctatus</i> , Theo. ...			x	
<i>A. sudanensis</i> , Theo. ...			x	x
<i>A. nigerensis</i> , Theo. ...			x	x
<i>Culex tigripes</i> , Grandpre ...		x	x	x
<i>C. poecilipes</i> , Theo. ...	x		x	
<i>C. nebulosus</i> , Theo. ...	x		x	
<i>C. univittatus</i> , Theo. ...	x		x	x
<i>C. laurenti</i> , Newst. ...	x		x	x
<i>C. pipiens</i> , L. ...			x	x
<i>C. perfuscus</i> , Edw. ...	x		x	
<i>C. simpsoni</i> , Theo. ...	x		x	
<i>C. trifolius</i> , Edw. ...			x	
<i>C. argenteopunctatus</i> , Ventrillon			x	
<i>C. annulioris</i> var. <i>consimilis</i> , Theo. ...	x			

PROGRESS OF WORK.

The work carried out in hospitals and dispensaries continues to increase although attention is at present being paid to preventive rather than curative medicine and most of the additional funds available are being spent in developing the former.

CURATIVE MEDICINE.

The following table shows the number of inpatients, outpatient attendances and operations performed during the last ten years:—

YEAR.	Inpatients Admitted.	Outpatient Attendances.	Operations Performed.
1929	46,033	2,675,085	4,337
1930	49,911	3,840,923	6,110
1931	59,736	4,044,439	6,798
1932	59,642	4,264,412	7,287
1933	70,315	5,092,999	8,609
1934	85,990	6,039,197	10,082
1935	89,093	6,112,303	11,124
1936	96,081	6,500,441	11,229
1937	101,088	6,675,989	12,063
1938	104,366	6,989,990	11,439

Although the hospital and dispensary services have not been extended to any extent, and additional facilities have only been provided where urgently required, the work still increases. It is considered however that this increase is not likely to continue much longer.

It has already been found in the northern and central Sudan that the number of patients is beginning to vary with the state of public health. There is reason to believe that as a result of the improved public health services in this part of the country the amount of sickness is now declining. Any decrease in work in this area is however at present more than counterbalanced by the continual increase in medical work in the southern Sudan where there is far more sickness than in the north.

In the southern Sudan although it has numerous hospitals, dispensaries and chiefs dressers and is receiving its share of qualified hospital staff, who are kept fully occupied, there is a considerable amount of sickness still untreated. The medical administration in this area is unlikely to develop much further

owing to the high cost of transport over the immense distance which separates it from Khartoum, which affects both personnel and services. Even the cheapest drugs become costly when the transport costs on river and road are taken into consideration. The amount of medical work carried out per head of the population already exceeds that of the northern Sudan. Fortunately much of the sickness is due to preventable endemic disease such as guinea worm and ancylostomiasis. When preventive medicine plays its full part and the public health improves, it is hoped that hospital congestion will be relieved and that the present hospital and dispensary service will prove adequate for local needs.

During the year the programme of improving existing facilities and bringing the hospital buildings up to standard has been continued, and much has been achieved in this respect.

In the western and northern Sudan the programme is nearly completed and it is to the eastern and southern areas including Khartoum that attention will be mainly paid in the near future.

No new hospitals have been opened during the year.

PREVENTIVE MEDICINE.

Every effort is being made to develop this branch of the service, and much has been done during the year. The network of Sudanese sanitary supervisory officials is practically complete throughout the country except in the southern Sudan where training of local staff takes longer and is more difficult.

As a minimum a sanitary officer is now posted in a province with several junior public health officials working under him.

Constant propaganda is being organised in connection with anti-malarial precautions such as use of nets, and insecticide. Attention has also been paid to improvement of housing, cleanliness, diet etc. The various agricultural shows which are held in the country districts have afforded valuable opportunities for educating the population in public health. Much attention has been paid to the improvement of Sudanese housing, and an advisory committee in Khartoum is at present engaged in this problem. The school medical work is being organised and developed throughout the country as rapidly as possible.

Both village wells and piped water supplies in towns are being improved as fast as funds permit; filtered, piped water supplies are at present being installed for the towns of Wadi Halfa and Malakal and the Atbara water works are being brought up to modern standards.

Sanitation is being rapidly improved and the stimulus given to provincial authorities by the local sanitary staff has resulted in an embarrassing number of proposals for sanitary improvement. Anti-mosquito work is being intensified particularly in the Northern Province, and much attention is being paid to improvement of town layouts, and to the planning of new towns. Diets in prisons, schools and hospitals are under constant supervision, and efforts are being made to persuade the people to improve their diet in any way which is indicated such as the growing and eating of fruit and vegetables. It is worth mentioning that typical cases of food deficiency diseases are not common in the Sudan, and that compared with most African peoples the Sudanese appear to be well favoured as regards nutrition.

There are however obvious defects in the diet of many districts, and there is no doubt that much can be done to improve health and resistance to disease by improving nutrition where local conditions make it possible. A committee has been formed to investigate the problem and coordinate the activities of the various departments concerned.

The Graphic Museum has proved to be most useful in public health propaganda of all kinds both by exhibiting sections on food, housing, etc., and by providing models, charts, posters, etc., for exhibiting at province Agricultural Shows.

LABORATORIES AND RESEARCH.

This section is now complete as regards buildings and development.

The production of calf lymph, recently started, has proved of immense value during the year in dealing with numerous small outbreaks of smallpox throughout the northern Sudan . 1,300,000 units were issued, and it is largely due to its high potency which gives nearly 100% successful "takes" in the unvaccinated that it was possible to control the disease effectively.

The Malariologist in the Gezira continues to carry out investigations and is obtaining results of considerable practical application in dealing with the difficult malaria problem in the Gezira and the Jebel Aulia reservoir area.

TRAINING.

The Medical School is now fully organised on a five year course and the Conjoint Board of the Royal Colleges in England have recognised the time spent in taking the course as counting towards taking a conjoint qualification provided a matriculation standard is reached before the students enter the school.

The training of sanitary officers and sanitary overseers has been carried out at full pressure during the year also, of dispensers, medical assistants and hospital orderlies. The Nurses Training School and the Midwives Training School continue to perform excellent work.

TRAINING.

Courses of training are organised for the following categories of medical and sanitary staff:—

Medical Officers	Sanitary Officers
Dispensers	Sanitary Overseers
Medical Assistants	Female Nurses
Asst. Radiographers	Midwives
Laboratory Attendants	
Hospital Orderlies	

90% of the male classified officials of the Sudan Medical Service are Sudanese.

Medical Officers. (See Kitchener School of Medicine Report page 95.)

Dispensers.

A two years course of training was continued during the year. Three selected medical assistants are under training.

Medical Assistants.

Nine selected hospital orderlies underwent a twelve months course at Omdurman hospital which had not been completed by the end of the year.

Laboratory Attendants (See page 72).

Assistants Radiographers.

One was under training during the year.

Hospital Orderlies.

A six months course in nursing and hospital routine for senior orderlies from provincial hospitals was held at the Khartoum Civil Hospital under the Matron.

Nurses Training School.

17 pupils were accepted for training during the year of whom 5 were discharged for various reasons.

Twelve were examined on completion of a two years course of training and six were successful.

Midwives Training School. (See page 60.)

Sanitary Officers. (See page 37.)

Sanitary Overseers. (See page 37.)

Post-Graduate Training.

Two Sudanese doctors completed a three months course of post-graduate study in London, one at the British Postgraduate Medical School and one at the Pathological and Histological Laboratories of the Archway Hospital.

KITCHENER SCHOOL OF MEDICINE.

ANNUAL REPORT.

BY MR. J. S. ALDRIDGE.

Number of Students.

Eleven new students were admitted to the Medical School at the beginning of the year.

The classes were composed as follows :—

1st Year	...	...	...	...	...	...	11
3rd Year	...	...	...	...	...	...	8
5th Year	...	...	...	...	...	...	8
TOTAL							<hr/> 27 <hr/>

NOTE.—The 5th year class included one student who failed in his special final examinations in 1937.

Progress of Classes.

Professional examinations were held in 1st, 3rd and Final Year Subjects.

1st Year Examination Results.

Eleven students were examined in Biology, Chemistry and Physics. Of these seven students reached the required standard and will continue their medical studies. The remaining four were not allowed to proceed with their medical studies.

The Biology Prize was awarded to Mahmud Hussein Mahmud.

The Chemistry and Physics Prize was awarded to Hassan Mousa Ibrahim.

3rd Year Examination Results.

Eight students were examined in Anatomy and Pharmacology. All students reached the required standard and passed on to their clinical studies.

The Anatomy Prize was awarded to Daoud Mustafa.

The Pharmacology Prize was awarded to Soliman Modawi.

Special Final Examinations.

Special Final Examinations in Public Health, Pathology and General Paper were held in April, 1938 for the student Mohamed Adam Adham who was referred in his final examinations in 1937. The candidate was successful and recommended for the diploma to practise Medicine in the Sudan.

Final Examinations 1938-39.

Seven candidates were examined in Medicine, Surgery, Midwifery and Gynaecology. Six candidates were successful and recommended for their diplomas to practise in the Sudan. One candidate was failed in Medicine and, subject to conditions, will be allowed to sit for the examination in April, 1939.

The successful candidates were (in order of merit) :—

Sid Ahmed Abdel Hadi
Mohyi El Din Mahdi
Mohamed El Amin Abdel Rahim
Labib Abdalla
Mohamed Sherif Daoud
Sayed Ali Abdel Rahim

Prizes were awarded as follows :—

<i>Surgery Prize</i>	...	...	...	...	Sid Ahmed Abdel Hadi
<i>Midwifery and Gynaecology Prize</i>	...	...	...	...	Sid Ahmed Abdel Hadi
<i>Medicine Prize</i>	...	...	...	...	Mohyi El Din Mahdi

Examiners.

The Final Examinations were conducted under the supervision of a "Visitor" from the Royal Colleges of Physicians and Surgeons, Sir Alfred Webb-Johnson, C.B.E., D.S.O., F.R.C.S.

Drs. R. H. Bland, F. Bartholomew and R. M. Humphreys were the three external examiners in Medicine, Surgery and Midwifery and Gynaecology respectively.

Teaching Staff.

Dr. D. R. Macdonald who has held the post of Registrar since 1931 was transferred and Dr. J. S. Aldridge was appointed as his successor.

Mr. F. G. S. Whitfield retired from the lectureship in Biology and Dr. H. Knowlson was appointed in his place.

School Council.

Mr. B. W. Whitfield retired from the membership of the School Council.

Mr. H. W. Bedford resigned from the membership of the School Council as he is no longer concerned with the Kitchener School of Medicine.

Drs. J. S. Hovell and A. R. McKelvie (Lecturers in Midwifery and Gynaecology, and Ophthalmology respectively) were appointed members of the School Council.

General.

The end of the academic year showed signs of the impending arrival of the Science School. This School will be housed in the Kitchener School Buildings for two years and various minor alterations have had to be made for their reception.

Arrangements have been made for the Post Graduate teaching which starts in 1939.

HEALTH

OF THE

SUDAN DEFENCE FORCE

BY MR. N. MACLEOD.

GENERAL.

The health of the Sudan Defence Force was satisfactory and showed an improvement over that of the last two years.

The following table compares the sickness rate for the last ten years :—

YEAR		Average Annual Strength	Admissions	Average Constantly Sick	Ratio per 1000 of strength		Days lost through sickness	
					Admissions	Average Constantly sick	For whole force	For those sick
1929	...	7,024	4,916	145.20	699.88	20.67	7.54	10.78
1930	...	6,527	4,817	158.91	738.01	24.34	8.88	12.04
1931	...	5,333	4,194	96.65	786.42	18.11	6.61	8.41
1932	...	4,828	4,054	111.70	839.68	23.13	8.44	10.05
1933	...	4,919	4,097	120.50	832.89	24.49	8.94	10.73
1934	...	4,715	4,219	132.27	894.80	28.05	10.24	11.44
1935	...	4,726	3,419	121.34	723.44	25.67	9.41	13.00
1936	...	4,440	3,669	117.24	826.35	26.40	9.64	11.66
1937	...	4,444	3,638	120.84	818.63	27.19	9.92	12.12
1938	...	4,438	3,604	104.51	812.07	23.54	8.59	10.58

MALARIA.

Due to abnormal, badly spaced rains the incidence of malaria was heavy throughout the northern Sudan and was the major cause of hospitalisation of troops. The disease accounted for 28% of the total admissions but in certain stations the percentage was as high as 50. The incidence in the Equatoria Province in the south showed a reduction.

The following table shows the admissions for malaria during the past ten years :—

YEAR.							Cases.	Ratio per 1,000 of strength.
1929	...	...	...	...	...	...	1,165	165.86
1930	...	...	...	...	...	...	706	108.16
1931	...	...	...	...	...	...	741	138.94
1932	...	...	...	...	...	...	810	167.7
1933	...	...	...	...	...	...	1,140	231.77
1934	...	...	...	...	...	...	1,185	272.5
1935	...	...	...	...	...	...	894	187.5
1936	...	...	...	...	...	...	977	220.04
1937	...	...	...	...	...	...	748	168.31
1938	...	...	...	...	...	...	1,002	225.77

LEISHMANIASIS.

No case is reported this year from the Gedaref area where 15 cases were reported in the previous year. Two cases were admitted in non-endemic areas.

CEREBROSPINAL MENINGITIS.

One case was reported from Darfur.

MUMPS.

Small epidemics occurred in Shendi and Darfur.

VENEREAL DISEASE.

The incidence of syphilis, with 161 cases, remains at exactly the same figure as in the previous year. Frequent inspections and propaganda have considerably reduced the incidence of gonorrhoea in the northern Sudan. The increase of this disease however in the Wau garrison of the Equatorial Corps is not so satisfactory and is attributable to venereal disease having become increasingly prevalent in Wau town.

YEAR.	ARABS.		EQUATORIAL.	
	Admissions.	Ratio per 1000 of strength.	Admissions.	Ratio per 1000 of strength.
1929	646	111.09	80	58.73
1930	685	106.91	64	46.98
1931	594	135.4	49	51.81
1932	570	143.0	57	67.69
1933	595	145.44	52	62.8
1934	561	144.3	32	38.6
1935	501	128.7	58	69.6
1936	457	124.6	51	65.9
1937	520	141.9	72	92.3
1938	485	132.6	89	113.9

THE FOLLOWING TABLE SHOWS THE SICK RATE, ADMISSIONS, ETC., BY STATIONS.

STATION.	Average Annual Strength.	Admissions.	Total No. of days of Sickness.	Average Constantly Sick per 100 of strength.	Average No. of Days lost through sickness	
					Whole Force.	Those sick.
Khartoum	918	573	6,536	1.9	7.1	12.1
Shendi	516	416	3,478	1.8	6.7	8.3
El Obeid	503	427	3,977	2.1	7.9	9.3
Bara	194	187	1,511	2.1	7.8	8.1
Dilling	159	33	306	2.9	10.6	10.5
Kadugli	216	127	1,380	2.2	8.2	9.3
Kassala	362	192	1,783	2.7	10.0	11.9
Gedaref	393	305	3,631	2.3	8.3	9.5
Fasher	198	342	3,272	3.9	14.4	10.1
Geneina	198	281	2,855	2.0	7.4	13.5
Nyala	352	108	1,459	2.1	7.6	13.8
Torit	143	194	2,674	1.5	5.6	4.9
Kapoeta & Boma	86	165	807	3.7	13.4	9.8
Taali	200	117	1,151	4.5	15.6	19.2
Wau		161	3,260			
Aweil		12	66			
TOTALS	4,438	3,604	38,146	2.35	8.59	10.58

The following table shows the admissions by diseases in the various stations :—

ADMISSIONS TO HOSPITALS FOR N.C.Os. AND MEN DURING 1938.

	Pulmonary T.B.	Non-Pulmonary T.B.	Syphilis	Gonorrhoea	Soft Sore	Trachoma	All Other Eye Diseases	Ear	Skin	Wounds and Other Injuries	Poisoning	Ancylostomiasis	Bilharziasis	Filariasis	Dysentery Bacillary	Dysentery Amoebic	Malaria	Leishmaniasis	Yaws	Dracontiasis	Tropical Ulcer	Cerebro Spinal Meningitis	Chickenpox	Influenza	Mumps	Measles	Pneumonia	Tumours Malignant	Tumours Non-Malignant	Madura Foot	Tonsillitis	Tetanus	Rheumatic Fever	Diabetes	Circulatory System	Respiratory System	Alimentary System	Genito-Urinary System	Nervous System	Fever of Unknown Origin	All Other Diseases	Total	
Khartoum	3	—	20	64	8	2	19	11	—	103	1	—	6	—	—	3	129	—	—	—	—	—	—	4	16	3	3	1	—	—	—	1	—	—	—	10	26	21	12	1	35	39	537
Shendi	—	—	17	34	—	2	16	3	3	129	—	—	—	—	—	7	71	—	—	—	—	—	—	—	16	24	—	16	—	—	—	—	—	—	—	—	—	—	13	7	416		
El Obeid	1	—	14	32	13	7	1	1	1	67	—	—	2	—	2	15	169	—	—	—	—	—	—	35	4	8	—	—	16	2	—	—	—	—	1	6	23	3	1	1	4	427	
Bara	—	—	10	16	—	9	—	—	1	27	—	—	1	—	—	—	83	—	—	—	—	—	—	—	4	3	—	—	9	1	—	—	—	—	—	—	4	—	—	—	187		
Kadugli	—	—	9	9	2	1	—	—	—	14	—	—	—	—	—	7	48	1	—	—	3	1	—	—	—	—	—	3	—	—	—	—	—	—	—	—	3	4	2	127			
Dilling	—	—	2	3	1	1	—	—	—	7	—	—	—	—	—	2	11	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	1	3	—	—	—	4	33		
Kassala	—	—	13	9	3	6	—	—	—	22	—	—	—	—	—	11	111	—	—	—	—	—	—	1	—	—	1	—	6	—	—	—	—	—	—	—	1	20	2	305			
Gedaref	—	1	13	71	3	9	—	—	—	35	—	—	—	—	14	14	80	—	—	—	—	—	2	4	31	2	—	3	—	1	—	—	—	—	—	—	8	—	—	—	342		
Fasher	1	—	29	50	3	2	—	—	1	34	1	2	—	—	3	15	170	—	—	—	2	—	—	1	—	35	17	5	—	—	—	—	—	—	—	—	—	—	—	7	281		
Geneina	—	—	6	17	3	2	—	—	1	78	—	—	6	—	—	5	51	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	108		
Nyala	—	—	8	6	—	1	2	—	1	13	—	—	1	—	—	5	36	—	—	—	16	—	—	3	10	35	—	—	—	—	—	—	—	—	—	—	—	—	—	—	31	194	
Torit	—	—	2	2	1	10	2	—	2	54	—	—	—	—	15	15	24	1	3	7	16	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	8	165	
Kapoeta and Boma	—	—	—	1	—	6	—	—	3	83	—	—	—	—	5	5	5	—	—	9	9	—	—	—	6	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	7	117	
Taali	—	—	—	4	—	—	—	4	—	45	—	—	—	—	—	—	14	—	—	—	—	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	161		
Wau	1	—	18	59	—	—	—	—	2	42	—	2	2	2	—	—	—	—	—	—	4	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	12	
Aweil	—	—	—	2	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
TOTAL	6	1	161	379	34	15	81	22	14	757	2	4	18	2	2	102	1002	2	19	52	11	1	50	91	92	6	40	1	3	2	1	1	7	1	17	183	163	34	18	83	124	3,604	

MEDICAL WORK CARRIED OUT BY MISSIONS.

The following table shows the work carried out by Medical Missions :—

	Inpatients	Outpatient Attendances	Operations
THE CHURCH MISSIONARY SOCIETY.			
Omdurman	1,433	93,183	269
Lui (Equatoria Province) ...	557	126,680	160
Zeraf Island (Upper Nile) ...	258	4,965	159
Ler (Upper Nile)	79	7,283	44
Salara (Nuba Mountains) ...	132	9,267	1
THE SUDAN UNITED MISSION.			
Heiban (Nuba Mountains) ...	—	8,125	2
Abri (Nuba Mountains) ...	156	5,358	—
Tabanya (Nuba Mountains) ...	57	4,284	—
Rom (Upper Nile)	36	2,926	—
THE AMERICAN MISSION.			
Doleib Hill (Upper Nile)... ..	—	18,271	—
Nasir (Upper Nile)	—	10,885	1

ORGANISATION.

The organisation of the Sudan Medical Service is shown graphically in the attached chart. The administration is divided into three sections—Public Health, Hospitals, and Laboratories and Research, each under an Assistant Director. In addition there are four senior specialists in medicine, surgery, obstetrics and ophthalmology who are directly responsible to the Director, although the routine work of their hospitals is supervised by the Assistant Director (Hospitals).

STAFF.

There are 44 British doctors in the Sudan Medical Service of whom 11 are carrying out administrative, public health or specialist work, leaving 33 available for routine duties. The British doctors are termed Medical Inspectors and they are not as a rule stationed at the hospitals (except in the case of the larger ones) but exercise a general supervision over the hospitals and dispensaries of a province or large district. They act as consultants to the hospital medical officers. A Senior Medical Inspector is in charge of each province with a number of British and Sudanese doctors under him; the latter are now taking over supervisory posts previously held by British staff. The medical officers in charge of hospitals and their assistants are Sudanese doctors who have qualified at the Kitchener School of Medicine, Khartoum. The Kitchener School of Medicine is a non-Government organisation which is controlled as regards its academic work by a School Council of which the Director, Sudan Medical Service is chairman (*ex-officio*). The school is in charge of a Registrar who is a British Doctor seconded from the Medical Service.

The training of subordinate Sudanese medical staff is carried out in hospitals under the supervision of the Assistant Director (Hospitals).

HOSPITALS.

In Khartoum there are two teaching hospitals with 400 beds in all, mostly allotted to the four specialist departments. These hospitals are at present being rebuilt and, on completion of the present approved scheme in about two years time, Khartoum will possess a complete medical unit comprising the Medical School, Students Hostel, Stack Laboratories, a new Hospital of 500 beds, British Sisters Quarters, Public Health Offices, Graphic Museum and Medical Service Headquarters all sited adjacent to one another in an extensive area near Khartoum Central Railway Station. This site is convenient as a large number of patients arrive by train, and the Stack Laboratories have a travelling laboratory saloon. There is in addition a teaching hospital of 240 beds in Omdurman, 7 miles away, and a small hospital in Khartoum North.

The provincial organisation consists of a parent hospital, which is the headquarters of the Senior Medical Inspector in charge of the Province, with several small outlying hospitals. A network of dispensaries and dressing stations is based on each hospital. As much routine outpatient and inpatient treatment as possible is decentralised to the smaller hospitals and dispensaries.

Hospitals are classified as A, B, or C types. Type "A" hospitals, where both British doctors and sisters are permanently stationed, number six. These are fully equipped including, where possible, X-Ray facilities. Type "B" hospitals, of which there are 10, are usually situated at Province headquarters. There are 22 type "C" or small hospitals. These are dependent to a large extent on type "A" and type "B" hospitals.

In the southern Sudan a hospital ship and barge, fully equipped with operating theatre, a laboratory and accommodation for 40 inpatients brings medical assistance to the inhabitants of the vast swamps of the Upper Nile who can be reached in no other way. Serious cases are conveyed to the parent hospital at Malakal. A large fast motor launch is employed for inspection duty on the Dongola reach of the Nile to enable close supervision to be exercised over the network of dispensaries and dressing stations in this area. Here an intensive campaign is in progress against bilharziasis and malaria.

NURSING.

Nursing is carried out by Sudanese male orderlies in the men's ward and by female nurses in the women's wards.

In the "A" Type hospitals British sisters, of whom there are 17 in all, supervise the nursing and train Sudanese nurses and midwives at the training schools in Khartoum.

LABORATORIES.

The Assistant Director (Research) is responsible for the staffing and supervision of hospital laboratories and for the training of Sudanese officials at the Stack Laboratories, Khartoum to which laboratory assistants from the provinces return from time to time for refresher courses.

PREVENTIVE MEDICINE AND PUBLIC HEALTH.

Khartoum Province, owing to the specialised nature and importance of public health work, is in charge of a British Medical Officer of Health. This appointment has the added advantage in that the Assistant Director (Public Health) is understudied by another public health specialist. The Medical Officer of Health, Khartoum is assisted by four British sanitary inspectors and one sanitary officer. A further eight British sanitary inspectors and ten Sudanese sanitary officers are stationed in the provinces.

Training of public health officers is carried out by the Public Health Department in Khartoum under the supervision of the Assistant Director (Public Health).

Although it has been found convenient at Headquarters to separate the curative from the preventive branches of the service by appointing Assistant Directors for each this does not hold good in the provinces where the Senior Medical Inspector is responsible for all medical and health work carried out in his area.

In each province a British sanitary inspector or a Sudanese sanitary officer is responsible to the Senior Medical Inspector for all public health services, and subordinate to him is a cadre of public health officials who form a network over the province. The latter are directly responsible for the public health work in the towns and in areas where special public health

measures are being carried out. They further act largely in an advisory capacity to the subordinate medical staff and to the native authorities in the rural districts.

In general it has been found that better results are obtained in the provinces if the same official is responsible for both curative and preventive medicine. The personal popularity gained by curative medicine can then be utilised to introduce the often unpopular preventive measures. It should be pointed out perhaps that hospitals and dispensaries in the Sudan are of considerable direct importance to public health, for they act as medical intelligence centres and treat and cure diseases such as malaria, dysentery, sleeping sickness, and infectious disease. In addition, early outpatient treatment prevents much hospitalisation and chronic illness later and for this reason special attention is paid to the provision of adequate outpatient facilities at hospitals; at the same time every care must be taken to ensure that the number of hospitals is not in excess of requirements. 38 hospitals for a territory comprising 1,000,000 square miles cannot be considered excessive, and every care has been taken to ensure that the standard of building and facilities provided is the minimum necessary to enable the work to be carried out efficiently. It is also essential that an adequate standard of hospital administration and accommodation be maintained. The quality of hospital and dispensary work achieved depends to a considerable extent, particularly as regards Sudanese staff, on the conditions under which work is carried out. Efficient treatment will gain the confidence of the tribesmen far more effectively and permanently, although possibly more slowly, than the provision of indifferent accommodation, which, while creating a home from home, lowers the standard of hospitals and dispensaries. The Sudanese are quick to appreciate the benefits of treatment in clean well-disciplined hospitals and the disadvantages of a dirty, ill found institution. The popularity of the Sudan hospital and dispensary services is undoubted. This is evidenced by the great amount of work dealt with and by the appreciation of the facilities made available.

The fact that it is not always in the public interest to separate the public health and curative services is well illustrated if one considers the medical organisation which at present caters for the smallest unit of population. The medical unit is the dispensary, staffed by a trained medical assistant and a hospital orderly which caters for a small area, probably comprising several villages or a section of a tribe. The dispensary may have accommodation for in-patients but is not as a rule dieted. Attached to the dispensary there may be dressing stations in the outlying villages, each under an orderly. These are visited frequently by the medical assistant who tours his district, usually on a donkey. Even if there are no dressing stations attached to the dispensary the medical assistant carries out regular and frequent inspections of villages and centres of population. In nomadic and tribal districts sheikhs' and chiefs' dressers may replace the dressing stations. These men are local tribesmen who receive training and refresher courses at a central hospital and move with the tribe. In certain circumstances it may be necessary for the whole dispensary unit to tour the district.

In all these activities curative and preventive measures are practised simultaneously. District midwives are under the supervision of the medical assistant. They are of immense value in that they are able to introduce through the women themselves simple hygiene into the very heart of village life and into the homes of the people. A midwife spends a fixed period daily at the dispensary, assisting in the outpatient treatment of women and children. The dispensary is also usually the registration authority for births and deaths in the district.

The public health service exercises a direct control over the area by means of sanitary overseers. These men are of the same standing as the medical assistant and have passed a special qualifying examination in public health. A sanitary overseer is really the technical adviser in public health of the medical assistant who is responsible for the public health of his area. In some areas however where the public health services have to deal with endemic diseases such as malaria on a large scale, the sanitary overseer is directly responsible and has a large subordinate staff of mosquito men under him who form part of a comprehensive network covering the whole area affected. An example of this is the main Nile between Wadi Halfa and Khartoum where about 900 miles are closely supervised by a chain of mosquito men and sanitary overseers.

To summarise, the medical assistant is responsible for curative and preventive medicine in his area. He is assisted by midwives and he has at his service the technical assistance of a public health official, usually a sanitary overseer. The latter exercises this function over an area comprising many dispensaries, and in certain cases may take over responsibility for special public health measures with his own staff. Ancillary services of dressing stations and chiefs' dressers are organised where necessary and are under the regular inspection of the medical assistant. The medical organisation of the rural areas has been described in detail because it is the means by which the improvement in the health of the bulk of the population is being effected, and because it illustrates the advantages of merging to a large extent the curative and preventive branches of the medical service. It is only through the cooperation of the medical assistant, sanitary overseer and midwife in preventive medicine that the problem of public health improvement in rural areas can be achieved. Needless to say the whole organisation is under continual close inspection by senior provincial medical staff.

STAFF.

SUDAN MEDICAL SERVICE

1938.

Approved Budgetary Establishment of Classified Officials.

APPOINTMENT.	Establishment.
Medical Staff.	
Director	1
Assistant Director (Public Health)...	1
Assistant Director (Hospitals) ...	1
Senior Physician	1
Senior Surgeon	1
Obstetric Surgeon and Gynaecologist	1
Medical Officer of Health Khartoum	1
Ophthalmic Surgeon	1
Assistant Ophthalmic Surgeon ...	1
Registrar Kitchener School of Medicine	1
Senior Medical Inspectors	19
Medical Inspectors	14
Medical Sub-Inspector	4
Syrian Medical Officers	2
Sudanese Medical Officers	59
Assistant Medical Officers	251
Dispensers	3
Radiographer	1
Assistant Radiographers	2
Classified Head Tumergies.	31
Theatre Attendants	24
Stack Medical Research Laboratories.	
Assistant Director, Laboratory Services ...	1
Government Bacteriologists	2
Laboratory Assistants (British)	4
Laboratory Assistants (Sudanese)	34
Nursing Staff.	
Principal, Midwives' Training School ...	1
Assistant Principal Midwives' Training School	1
Staff Midwives (Sudanese)	3
Matron	1
Charge Sisters	6
Nursing Sisters	9
Sanitary Staff.	
Chief Sanitary Inspector	1
Senior Sanitary Inspectors	6
Sanitary Inspectors	5
Sanitary Officers	9
Sanitary Overseers	70
Clerical Staff.	
Superintendent	1
Staff Clerk	1
Clerks	16
Superintendent of Accounts... ..	1
Chief Accountant	1
Book-keepers	72
Medical Stores Staff.	
Chief Storekeeper	1
Storekeeper (British)	1
Storekeepers (Sudanese)	7

BRITISH MEDICAL STAFF

SUDAN MEDICAL SERVICE.

ON 31. 12. 1938.

Director,	...	...	...	Mr. E. D. Pridie, D.S.O., O.B.E., M.B., B.S., 3N.
Asst. Director (Public Health)				Mr. H. A. Crouch, O.B.E., M.C., M.R.C.S. L.R.C.P., D.P.H., 3N.
Asst. Director (Hospitals)	...			Mr. N. MacLeod, M.B., Ch.B., 4N.
Registrar, School of Medicine	...			Mr. J. S. Aldridge, M.R.C.S., L.R.C.P.

SPECIALIST APPOINTMENTS.

Senior Physician	...	...	Dr. R. M. Humphreys, D.M., B.Ch., 4N.
Senior Surgeon	...	...	Mr. F. S. Mayne, M.B., F.R.C.S.E.
Obstetric Surgeon and Gynaecologist			Mr. J. S. Hovell, M.B., F.R.C.S.E., M.C.O.G.
Ophthalmic Surgeon	...	...	Mr. A. R. McKelvie, M.B., Ch.B., D.O., D.O.M.S.
Medical Officer of Health	...		Mr. A.E. Lorenzen, M.R.C.S., L.R.C.P., D.P.H., 4N.

MEDICAL SECTION.

Senior Medical Inspector	...	Dr. A. Cruickshank, M.D., B.Ch., 4N.
„ „ „	...	Mr. C. E. G. Beveridge, M.R.C.S., L.R.C.P., 4N.
„ „ „	...	Mr. F. H. Goss, M.C., M.B., B.Ch.
„ „ „	...	Dr. L. H. Henderson, M.D., Ch.B., D.T.M. & H.
„ „ „	...	Mr. D. R. Macdonald, M.B., Ch.B.
„ „ „	...	Mr. E. P. Pratt, M.B., B.S.
„ „ „	...	Mr. G. D. Rankin, M.B., B.Ch.

Senior Medical Inspector	...	Mr. H. M. Elliott, B.Ch.
„ „ „	...	Dr. J. Bryant, M.D., Ch.B., F.R.C.P.E., D.T.M. & H.
„ „ „	...	Mr. C. B. Drew, M.R.C.S., L.R.C.P.
„ „ „	...	Mr. E. W. T. Morris, F.R.C.S.
„ „ „	...	Mr. H. M. Woodman, M.B., B.Ch.
„ „ „	...	Mr. A. P. Farmer, M.B., B.S., D.T.M. & H.
„ „ „	...	Dr. N. L. Corkill, M.M., M.D., Ch.B.
„ „ „	...	Mr. G. J. Clarke, M.R.C.S., L.R.C.P., D.T.M. & H.
„ „ „	...	Mr. L. Brown, M.R.C.S., L.R.C.P.
Medical Inspector	...	Dr. R. McN. Buchanan, M.D., Ch.B., D.T.M. & H.
„ „ „	...	Mr. H. Richards, M.B., B.S., D.T.M. & H.
„ „ „	...	Mr. E. K. Malone, M.B., B.Ch., B.A.O.
„ „ „	...	Mr. J. L. D. Roy, M.B., Ch.B.
„ „ „	...	Mr. F. Bartholomew, F.R.C.S.E.
„ „ „	...	Mr. R. W. Stephenson, M.R.C.S., L.R.C.P.
„ „ „	...	Mr. F. L. Wheaton, M.B., B.S.
„ „ „	...	Mr. J. F. E. Bloss, M.R.C.S., L.R.C.P., D.T.M. & H.
„ „ „	...	Mr. W. H. Greany, M.B., B.Ch.
„ „ „	...	Mr. A. Royland Hunt, L.R.C.P., L.R.C. (Ed.)
„ „ „	...	Mr. R. B. U. Somers, M.B., Ch.B., D.T.M. & H.
„ „ „	...	Mr. W. F. Townsend Coles, M.B., B.S.
„ „ „	...	Mr. R. T. Campbell, M.B., Ch.B.
„ „ „	...	Mr. H. D. Fairman, M.B., B.S.
„ „ „	...	Mr. C. A. Lewis, M.R.C.S., L.R.C.P.
„ „ „	...	Mr. E. O'D. C. Grattan, M.B., B.Ch., F.R.C.S.
„ „ „	...	Mr. G. F. E. Ramsden, M.B., Ch., B.

STACK MEDICAL RESEARCH LABORATORIES.

Asst. Director Laboratory Services	...	Dr. E. S. Horgan, B.A., M.D., B.Ch., B.A.O.
Bacteriologist	...	Mr. R. Kirk, M.B., Ch.B., B.Sc., F.R.F. P.S.G., D.P.H.

FINANCIAL.

The following figures show the actual Revenue and Expenditure of the Sudan Medical Service for the last three years :—

						1936	1937	1938
						£E.	£E.	£E.
1.	Revenue	...	...	...	...	47,323	44,800	45,219
2.	Expenditure :							
	Chapter 1.	Personnel and Personal						
		Allowances	...	...		154,728	162,510	168,582
	Chapter 2.	Services	...	...	...	98,372	102,212	111,569
	Chapter 3.	Extraordinary Expenditure				3,073	7,328	3,479
		TOTAL	...		£E.	256,173	272,050	283,630

TABLE I.

SHOWS ADMISSIONS AND DEATHS BY DISEASES.

DISEASE.				TOTAL.							
				Europeans.				Non-Europeans.			
				Male.		Female.		Male.		Female.	
				A.	D.	A.	D.	A.	D.	A.	D.
Table "A"											
Tubercular											
1.	Disease of lung ...	...	...	—	—	—	—	484	96	139	32
2.	All other tubercular diseases ...			1	—	—	—	302	27	101	9
Venereal											
3.	Syphilis ...	...	...	1	—	—	—	14,084	16	2,231	12
4.	Gonorrhoea ...	...	...	1	—	—	—	2,265	5	330	—
5.	Soft sore ...	...	...	1	—	—	—	337	1	9	—
Eye.											
6.	Trachoma...	...	...	—	—	2	—	369	—	131	—
7.	All other eye diseases ...	...	...	3	—	—	—	2,330	—	879	—
8.	Ear ...	...	...	3	—	—	—	310	3	75	—
9.	Skin ...	...	...	—	—	—	—	1,246	1	206	1
10.	Wounds and other injuries ...			55	3	11	—	15,676	155	1,965	70
Tumours.											
11.	Malignant ...	...	...	—	—	—	—	115	8	81	17
12.	Non-malignant ...	...	...	—	—	1	—	242	3	202	9
Of Women.											
13.	Gynaecological ...	...	...	—	—	5	—	—	—	710	15
14.	Confinements ...	...	...	—	—	28	1	—	—	564	40
15.	Poisoning ...	...	...	2	—	—	—	97	12	37	7
Total Table "A" ...				67	3	47	1	37,857	327	7,660	212
Table "B" (Tropical).											
1.	Ankylostomiasis ...	...	...	—	—	—	—	969	12	296	6
2.	Bilharziasis ...	...	...	—	—	—	—	1,694	6	190	5
3.	Blackwater Fever ...	...	...	1	—	—	—	24	8	4	—
4.	Dysentery, Amoebic ...	...	...	18	—	9	—	2,395	35	464	16
5.	Dysentery, Bacillary ...	...	...	4	—	2	—	116	12	20	3
6.	Filariasis ...	...	...	—	—	—	—	94	1	13	—
7.	Madura Disease ...	...	...	—	—	—	—	232	1	50	—
8.	Malaria ...	...	...	140	3	34	—	10,104	55	1,295	26
9.	Leishmaniasis (Kala-Azar) ...	...	...	—	—	—	—	223	41	51	6
10.	Trypanosomiasis...	...	...	—	—	—	—	59	1	51	—
11.	Yaws ...	...	...	—	—	—	—	1,128	3	406	—
12.	Sunstroke...	...	...	1	—	—	—	—	—	—	—
13.	Heatstroke ...	...	...	1	—	—	—	—	—	—	—
14.	Guinea-worm ...	...	...	—	—	—	—	784	1	48	—
15.	Tropical ulcer ...	...	...	—	—	—	—	4,261	8	670	5
Total Table "B" ...				165	3	45	—	22,083	184	3,558	67

TABLE I. (Continued).

					TOTAL.							
Disease.					Europeans.				Non-Europeans.			
					Male.		Female.		Male.		Female.	
					A.	D.	A.	D.	A.	D.	A.	D.
Table " C " (Infective).												
1.	Anthrax	...	...	...	—	—	—	—	—	—	—	—
2.	Beri-beri	...	...	...	—	—	—	—	—	—	—	—
3.	Cerebrospinal meningitis	...	...	...	—	—	—	—	20	10	5	5
4.	Chicken Pox	...	...	...	1	—	—	—	841	1	33	1
5.	Cholera	...	...	...	—	—	—	—	—	—	—	—
6.	Dengue	...	...	...	—	—	—	—	—	—	—	—
7.	Diphtheria...	...	...	...	1	—	1	—	30	9	19	4
8.	Enteric (including paratyphoid )	...	...	...	2	2	1	—	152	19	58	8
9.	Erysipelas	...	...	...	1	—	—	—	9	5	3	1
10.	Gastro enteritis of children	...	...	...	—	—	1	—	20	5	38	10
11.	Influenza	...	...	...	25	—	2	—	1,093	5	112	4
12.	Leprosy	...	...	...	—	—	—	—	250	4	58	5
13.	Measles	...	...	...	3	—	—	—	239	—	57	4
14.	Mumps	...	...	...	1	—	—	—	914	—	34	—
15.	Pellagra	...	...	...	—	—	—	—	9	—	—	—
16.	Puerperal fever	...	...	...	—	—	—	—	—	—	16	6
17.	Phlebotomus	...	...	...	—	—	—	—	3	—	—	—
18.	Plague	...	...	...	—	—	—	—	—	—	—	—
19.	Pneumonia (epidemie)	...	...	...	—	—	1	—	1,225	252	254	47
20.	Rabies	...	...	...	—	—	—	—	24	6	4	2
21.	Relapsing fever	...	...	...	—	—	—	—	922	61	9	1
22.	Rheumatic fever	...	...	...	—	—	2	—	260	4	30	—
23.	Smallpox	...	...	...	—	—	—	—	107	38	39	4
24.	Tetanus	...	...	...	—	—	—	—	21	6	8	1
25.	Typhus	...	...	...	—	—	—	—	—	—	—	—
26.	Undulant fever	...	...	...	—	—	—	—	26	3	2	—
27.	Whooping cough	...	...	...	—	—	—	—	29	2	26	3
Total Table " C "					34	2	8	—	6,194	430	805	106
Table " D."												
1.	Circulatory system	...	...	...	13	—	3	—	692	101	329	54
2.	Respiratory system	...	...	...	8	—	7	—	3,127	141	611	41
3.	Alimentary system	...	...	...	95	1	22	—	4 023	206	922	72
4.	Genito-urinary system	...	...	...	13	—	4	—	1,416	78	226	13
5.	Nervous system	...	...	...	5	1	—	—	325	33	78	5
6.	Scurvy	...	...	...	—	—	—	—	125	5	20	—
7.	Diabetes	...	...	...	1	—	1	—	79	8	37	6
8.	Fever of uncertain origin	...	...	...	8	—	6	—	1,057	49	145	18
9.	All other diseases	...	...	...	33	—	15	—	7,993	176	4,404	115
Total Table " D "					176	2	58	—	18,837	797	6,771	324
" " " A "					67	3	47	1	37,857	327	7,660	212
" " " B "					165	3	45	—	22,083	184	3,558	67
" " " C "					34	2	8	—	6,194	430	805	106
Grand Total					442	10	158	1	84,971	1,738	18,795	709

TABLE II.

SHOWS ADMISSIONS AND DEATHS IN HOSPITALS DURING 1938.

	EUROPEANS.			NON-EUROPEANS.		
	Adm.	Died	%	Adm.	Died.	%
Blue Nile Province :—						
Wad Medani	122	—	—	5,921	278	4.7
Wad Medani Prison ...	—	—	—	351	6	1.7
Abu Usher	—	—	—	3,007	70	2.3
Sennar	1	—	—	1,620	64	3.9
Singa	2	—	—	1,048	57	5.4
Roseires	—	—	—	702	35	4.9
Dueim	—	—	—	800	35	4.3
Kosti	—	—	—	1,082	31	2.9
Province Dispensaries ...	—	—	—	290	1	.34
Darfur Province :—						
Fasher	—	—	—	1,895	68	3.6
Geneina	2	—	—	1,902	21	1.1
Nyala	—	—	—	424	12	2.8
Province Dispensaries ...	—	—	—	6,940	56	.8
Equatoria Province :—						
Juba	10	—	—	3,050	57	1.9
Yei... ..	—	—	—	560	5	.9
Torit	—	—	—	1,197	15	1.3
Kapoeta	—	—	—	513	3	.6
Li Rangu	—	—	—	1,772	12	.7
Meridi	—	—	—	1,371	15	1.1
Source Yubo	—	—	—	721	10	1.4
Wau	—	—	—	2,674	50	1.9
Rumbek	—	—	—	1,656	61	3.7
Province Dispensaries ...	—	—	—	17,278	42	.2
Kassala Province :—						
Kassala	—	—	—	2,037	78	3.8
Gedaref	—	—	—	1,112	88	7.9
Port Sudan	117	7	5.9	3,338	102	3.1
Port Sudan Prison ...	—	—	—	174	8	4.5
Suakin	—	—	—	47	—	—
Suakin Quarantine ...	—	—	—	68	2	2.9
Province Dispensaries ...	—	—	—	1,132	5	.4
Khartoum Province :—						
Khartoum	251	4	1.6	3,596	230	6.4
Omdurman	—	—	—	2,680	191	7.1
Khartoum North ...	—	—	—	1,250	25	.2
River Hospital	1	—	—	1,921	14	.7

TABLE II—(Continued)

				EUROPEAN.			NON-EUROPEANS.		
				Adm.	Died	%	Adm.	Died.	%
Kordofan Province :—									
El Obeid	...	...	...	9	—	—	2,492	156	6.3
Nahud	...	...	...	—	—	—	1,039	38	3.7
Kadugli	...	...	...	—	—	—	1,557	16	1.02
Talodi	...	...	...	—	—	—	1,147	11	.9
Dilling	...	...	...	—	—	—	712	14	1.9
Province Dispensaries	...			—	—	—	10,250	99	.97
Northern Province :—									
Atbara	...	...	...	71	—	—	2,553	92	3.6
Shendi	...	...	...	—	—	—	462	16	3.5
Merowe	...	...	...	—	—	—	723	24	3.3
Dongola	...	...	...	—	—	—	1,008	24	2.4
Wadi Halfa	...	...	...	2	—	—	1,412	23	1.6
Province Dispensaries	...			—	—	—	352	65	18.5
Upper Nile Province :—									
Malakal	...	...	...	12	—	—	4,209	112	2.7
Province Dispensaries	...			—	—	—	1,721	10	.59
TOTAL				600	11	1.8	103,766	2,447	2.35

GRAND TOTAL ... 104,366 admissions, with 2,458.

TABLE III.

LIST SHOWING HOSPITALS AND DISPENSARIES 1938.

Parent Hospitals are shown in heavy type with dependant dispensaries immediately following.

Hospitals and Dispensaries	Beds. equipped	Hospitals and Dispensaries	Beds. equipped	Hospitals and Dispensaries	Beds. equipped
Blue Nile Province.		Blue Nile Province—Ctd.		Equatoria Province.	
WAD MEDANI	256	Attib	—	JUBA	175
Wad Medani Prison	33	Dar Agil	—	Juba Town	—
Abu El Hassan	—	Karkoj	5	Koggi	6
Abdel Galil	—	Lokandi	—	Lyria	12
Abdel Hakam	—	Suada	—	Taali	14
Abdel Rahman	—	ROSEIRES	100	Terrekekka	6
Derwish	—	Bikori	—	Toliang	4
El Gubshan	—	Geisan	—	TORIT	63
El Hosh	—	Kurmuk	5	Farajok	6
Fahal	—	Ora	—	Ikotos	6
Gawada	—	Soleil	—	Kyala	6
Gondal	—	Sereo	—	Lafone	6
Hag Abdulla	—	Wisko	—	Loa	6
Hamad El Nil	—			Opari	6
Kumor	—			KAPOETA	48
Madina	—			Boma	10
Managil	—	White Nile Sub-Province.		YEI	32
Messelemmia	—	DUEIM	52	Kajo-Kaji	42
Mohd. Zein	—	Kosti	88	Kala	—
Nidiana	—	Abu Rukba	—	Larumba	1
Nueila	—	Dar El Salam	1	Lassau	1
Radma	—	Geteina	1	Lita	1
Remeitab	—	Gulli	—	Loka	8
Saadalla	—	Jebelein	1	WAU	226
Seleimi	—	Kawa	—	Atok Tau	—
Sabi Doleib	—	Kerri-Kerra (D a r	—	Aweil	17
Shabarga	—	Ahamda)	—	Deim Zubeir	—
Shaigia	—	Maatuk	1	Gogrial	—
Tayba	—	Naima	1	Kuru	—
Tebub	—	Rahmania	2	Kwajok	—
Wad El Ataya	—	Shawal	—	Madal	—
Wad El Bur	—	Shegeig	1	Meshra	—
Wad Hussein	—	Tendelti	—	Marial Bai	—
Wad Naaman	—	Turra	1	Nyin Akok	—
ABU USHER	150	Travelling Dispensary	—	Pieli	—
Abu Gutta	—			Pongo	—
Amara Kassir	—	Darfur Province.		Raga	15
Abdel Magid	—	FASHER	138	Said Bandas	—
Debeiba	—	Kebkebia	1	Sopo	—
Dolga	—	Kuttum	2	Tiett	—
Fawar	—	Meidob	—	Tonj	11
Feteis	—	Mellit	—	Wun Rog	—
Hassaheissa	—	Taweisha	—	Wun Shwai	—
Hilallia	—	Um Buru	—	RUMBEK	160
Istarihna	—	Um Kedada	—	Aluak-Aluak	—
Kab El Gidad	—	Wadaa	—	Falwal	—
Kamlin	—	GENEINA	35	Kashual	—
Keteir	—	Geneina Town	—	Lau	—
Laota	—	Kulbus	—	Malau	—
Mailig	—	Mustere	—	Pap	—
Rufaa	—	NYALA	48	Shambe	40
Tabat	—	Abu Matariq	—	Toiyna	—
Turabi	—	Buram	—	Wol-Athiang	—
Turis	—	Id El Ghanam	—	Yirrol	30
Um Degersi	—	Kubbum	—	LI RANGU	165
Wad Rawa	—	Radom	—	Meridi	87
Wad Sulfab	8	ZALINGEI	18	Badagbo	—
SENNAR	130	Dreisa	—	Badi	—
Bardana	—	Garsilla	—	Bayango	—
Jebel Moya	—	Guldo	—	Gangura	—
Maierno	—	Kas	—	Iba	30
Sennar Junction	—			Lingasi	—
Suki	—			Ngindo	—
SINGA	100			Yambio	—
Abu Hashim	5				
Abu Hugar	—				

TABLE III.—*Ctd.*

Hospitals and Dispensaries	Beds. equipped	Hospitals and Dispensaries	Beds. equipped	Hospitals and Dispensaries	Beds. equipped
Equatoria Province—Contd.		Khartoum Province Contd.		Northern Province—Contd.	
SOURCES YUBO	80	RIVER HOSPITAL	200	Gadalla	2
Bakiri	—	Engineer Troops	—	Gandetu	2
Boma	—			Hilgi	—
Mabenge	—	KHARTOUM NORTH	35	Kabushia	—
Tambura	—	Khartoum North Prison	37	Kiteiab	2
Zuba	—	Ailafoun	—	Metemma	—
Balinguna	—	Deim Abu Saed	—	Mograt	2
		Geili	1	Shireik	2
Kassala Province.		Gereif East	—	Timeirab	—
Kassala	178	„ West	—	Teyba El Khawad	—
Abu Deleig	2	Gordon's Tree	—	Umbreika	4
Aroma	4	Halfayat el Meluk	—	Wad Hamid	4
Car Dispensary	—	Jebel Aulia	—	Zeidab	5
Derudeib	4	Khileila	—		
Digein	—	Kober	—	WADI HALFA	96
Goz Ragab	—	Mogren	—	Abri	—
Goz Ragab Travelling Dispensary	—	Shambat	—	Argin	—
Hadaliya	—	Sururab West	—	Delgo	—
Halenga	—	Tuti Island	—	Dobeira	—
Kassala Station	2			Dogheim	—
Khashm el Girba	2	Kordofan Province.		Farraig	—
Khashm el Girba Tra- velling Disp.	—	EL OBEID	155	Suarda	—
Khatmia	—	Bara	33		
Mekali	—	Rahad	22	MEROWE	72
Metatib	—	Shirkeila	—	Debba	—
Musmar	—	Soderi	6	Ghaba	—
Tendelai	—	Um Ruaba	50	Gureir	—
				Kareima	—
GEDAREF CIVIL	70	NAHUD	88	Korti	—
Gedaref Military	26	Ermil	5	Monassir	2
Doka	1	Ghabeish	5	M/Kotti	—
Gallabat	7	Abu Zabad	30	Nuri	—
Hawata	2	Keilak	2		
Hillet Hokuma	—	Lagowa	13	DONGOLA	64
Hiseihisa	—	Muglad	28	Amentago	—
Kassab	—	Odaiya	10	Argo	—
Mafaza	—	Suga-el-Gamal	5	Badeen	—
Gala En Nahal	3			Haffir	—
Showak	2	KADUGLI	100	Khandak	—
		Talodi	100	Seir	—
PORT SUDAN	174	Dilling	100		
Gebeit	13	Abbasia	20	Upper Nile Province.	
Gebeit Mines	—	Abu Gebeihia	10	MALAKAL	371
Oyo Mines	—	Buram	20	Abwong	20
Central Prison	24	Delami	45	Bor	10
Deim Medina	—	Eliri	20	Detwok	6
Deim Moussa	—	Ghofan	20	Doleib Hill	—
Deim Tigani	—	Gardud	5	Duk Faiwil	3
Quays Dispensary	—	Hammadi	10	Fangak	6
Quarantine Hospital	12	Heiban	20	Gambeila	5
Sinkat	—	Kau	10	Kaka	8
		Katla	20	Kodok	13
SUAKIN		Kauda	40	Kongor	8
QUARANTINE	30	Kilogi	10	Lul	4
Suakin Dispensary	10	Rashad	15	Nasir	5
		Shawai	10	Paloich	10
TOKAR	18	Tira Luman	5	Pibor	2
Akik	—	Um Brambeita	10	Renk	9
Gheit	—	Um Dorein	20	SS Lady Baker	2
Shellag	—			Tonga	12
		Northern Province.		Western Nuer	3
Khartoum Province.		Atbara	170	Yuin	—
KHARTOUM CIVIL		Shendi	71	Yoynyang	16
HOSPITAL	205	Abidia	—	Dwi Bor	—
Burri	—	Abu Hamad	6	Ler	—
Deims	—	Aliab	—	Rom	—
		Atmour	2	Nasir	—
OMDURMAN	188	Berber	4		
Murada	—	Bouga	4		
Technical School	—	Damer	1		
Wad Nubawi	—	Darmali	—		
		Eneibis	3		
				Total Beds Equipped	5,873

INDEX.

A.		Page
Admissions to hospital	....	100, 110
Aircraft, Sanitary Control	....	35, 88
Ancylostomiasis	....	10
Aedes Aegypti Survey	....	34
B.		
Beds equipped	....	114
Bilharziasis	....	10, 43
Blackwater Fever	....	12
Blue Nile Province	....	53
C.		
Cerebrospinal Meningitis	....	5, 47
Chickenpox	....	43
Child Welfare	....	62
Communicable Diseases	....	42
Chironomidae	....	88
Curative Medicine	....	91, 103
D.		
Darfur Province	....	57
Death, Analysis of causes of (Khartoum)	....	41
Deaths in Hospital	....	110, 112
Defence Force, health	....	97
Diphtheria	....	5, 44, 77
Dispensers	....	94
Disease, Prevention of	....	31
Dispensaries and hospitals	....	114
Dracontiasis	....	13
Dysentery	....	13, 44
E.		
Enteric Fever	....	14, 45
Entomology	....	81
Endemic Diseases	....	3
Epidemic Diseases	....	3
Equatoria Province	....	59
Espondia	....	15
Expenditure	....	107
G.		
General Health	....	1, 31
Gezira, Mosquito, Research in	....	81
H.		
Health of Provinces	....	38
Health General	....	1, 31
„ Khartoum	....	1
„ Officials	....	31, 102
„ Organisation	....	55
„ Port Sudan	....	31, 103
„ Public	....	97
„ Sudan Defence Force	....	102, 114
Hospitals and Dispensaries	....	35
Housing	....	14
Hydatid Disease	....	31
Hygiene	....
I.		
Infant Mortality	....	60
Influenza	....	6
Inpatients	....	110, 112
Inspectors, Sanitary	....	37

K.		Page
Kala Azar	....	14, 74
Khartoum Province	....	38
Kitchener School of Medicine	....	95
Kassala Province	....	54
Kordofan Province	....	57

L.		
Laboratory Assistants	....	72
Laboratories, hospital	....	72
„ Med. Research	....	71
Leprosy	....	17, 45
Leishmaniasis	....	14, 74
Lymph. Vaccine	....	77

M.		
Malaria	....	20, 33, 46
Maternity	....	60
Medical Officers	....	95
Medicine, Kitchener School	....	95
Meningitis, Cerebrospinal	....	5, 47
Meteorology	....	52
Midwives	....	60
Missions	....	101
Mortality, Infant	....	60
„ Maternal	....	60
Mosquito Research	....	46, 81

N.		
Neoplasms	....	73
Nurses	....	103
Nutrition	....	36
Northern Province	....	53

O.		
Officers, Medical	....	95
„ Sanitary	....	37
Officials Health	....	37, 103
Operations performed	....	91
Ophthalmic report	....	67
Orderlies, hospital	....	94, 103
Organisation and staff	....	102
Outpatients	....	91
Overseers, Sanitary	....	37, 102

P.		
Pilgrims	....	65
Port Sudan	....	55
Preventive Medicine	....	92, 103
Prison, Central	....	50
Progress of Work	....	2, 91
Public Health	....	31
Post-graduate Study	....	94

Q.		
Quarantine Port Sudan	....	3, 65
„ Suakin	....	3, 65
„ Wadi Halfa	....	3, 66
„ Medical Officers	....	95

INDEX.—(Continued)

R.	Page
Rabies	22, 47, 74
Radiographers	94
Rat Control	56
Research Laboratories	4, 71
Relapsing Fever	6, 47, 74
Revenue	107
Rheumatism, Acute	23

S.	Page
Salmonella Food Poisoning	77
Sand flies	87
Sanitary Control, aircraft	35, 88
" Officers	37
" Overseers	37
" Inspectors	37
Sanitation General	31
Schistosomiasis	10
School of Medicine	95
School, Midwifery Training	60
School Medical Service	51, 63
Scurvy	23
Sleeping Sickness	23
Smallpox	7, 48
Spleen	21
Stack Medical Research Labs.	4, 71
Staff, dispensary	
Staff, Public Health	37
Staff tables	106, 108
Suakin	3, 65
Sudan Defence Force	97
Supplies, Water	33
Syphilis	48

T.	Page
Trachoma	67, 75
Training	93, 94
Tuberculosis	26, 48
Tumours	28, 73
Typhoid Fever	14, 45

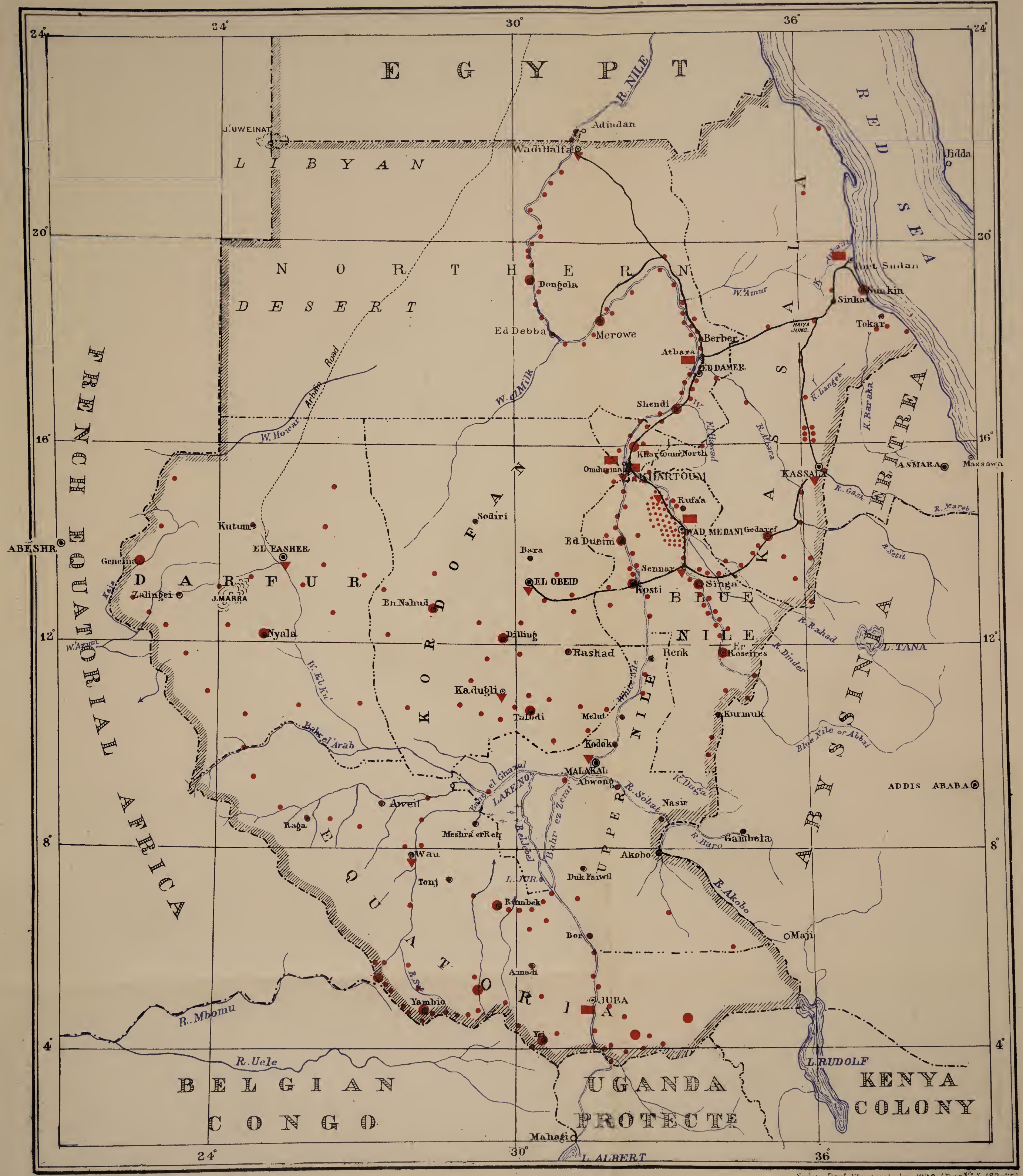
U.	Page
Undulant Fever	29
Upper Nile Province	58

V.	Page
Vaccination	8
Vaccines	77
Vital statistics	38
Veneral diseases	29

W.	Page
Water supplies	33
Wadi Halfa	3, 66

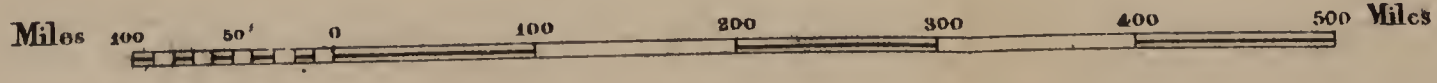
Y.	Page
Yaws	30
Yellow Fever	76, 86

THE ANGLO-EGYPTIAN SUDAN



Survey Dept. Khartoum, Jan. 1939. (Topo. N° S. 182-25)
July 1938 (Topo. N° S. 568-38)

Scale 1: 8,000,000



- "A" TYPE HOSPITAL
- "B" " "
- "C" " "
- DISPENSARY

